The Welding Engineer

Edited by L. B. Mackenzie

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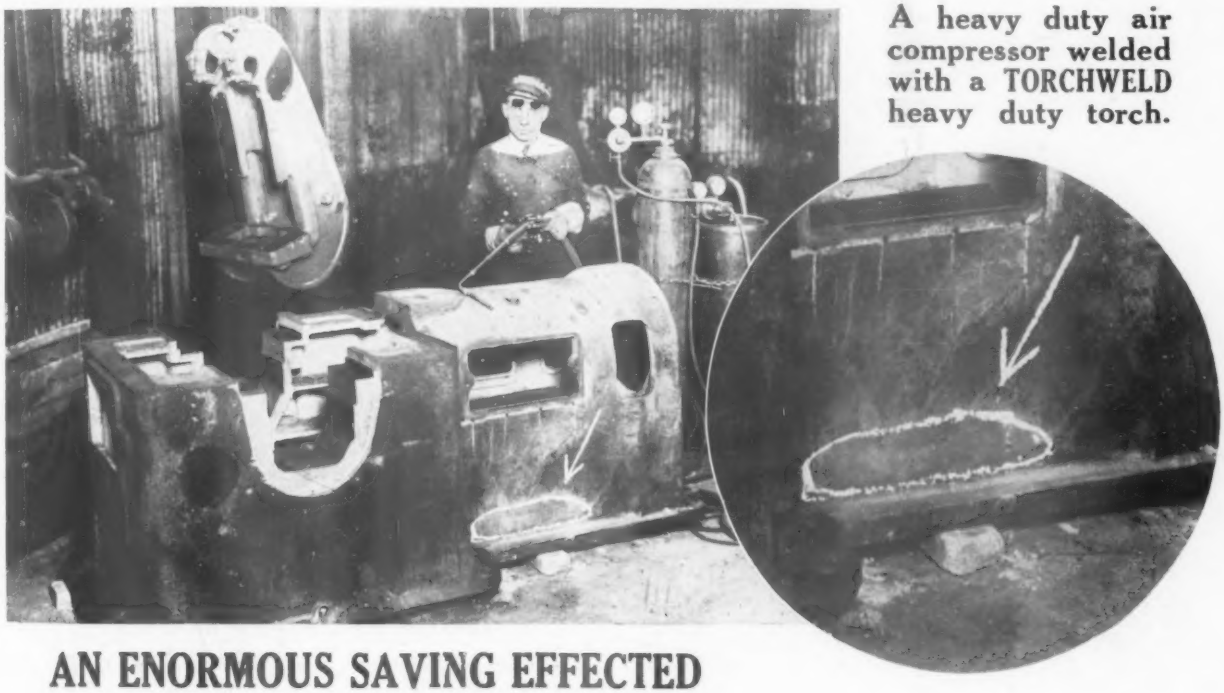

A heavy duty air compressor welded with a TORCHWELD heavy duty torch.

AN ENORMOUS SAVING EFFECTED BY THE TORCHWELD PROCESS

Here's an example of the possibilities of this process. The above casting was machined and ready for assembly when a serious defect developed.

$1200.00 represents the loss had the casting been discarded. This amount includes the cost of a new casting and the machine work on same.

Just one class of work that can be handled with our TORCHWELD No. 6 Heavy Duty Outfit.

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May we send you our new booklet telling of the advantages of the TORCHWELD PROCESS?

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The official proceedings of the American Welding Society will be found on Page 23.

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In fostering and developing the arts of welding and cutting from their inception, Oxweld has accumulated, and is daily increasing, a tremendous store of practical information on every phase of a great industry.

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CARBONS of Superior Quality for Electric Welding and Cutting

Carbon Specialties of all shapes for Gas Welding

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Readers of The Welding Engineer will find this index to contain the most accurate information obtainable relating to welding apparatus and supplies. The advertising section includes the principal manufacturers of the United States.

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Commercial Acetylene Welding Co.
Universal Oxygen Co.
Prest-O-Lite Co.

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Napolitan flux developed in the Davis-Bournonville laboratory as a result of many experiments is widely used in welding aluminum kitchenware and other aluminum products. Its action is marvelous; all resistant film is broken down and the molten metal flows like water. Atlas scaling powder eliminates scale, oxide and foreign matter from molten cast iron and facilitates clean welding. If you use D-B cast iron welding sticks and Atlas scaling powder you will have no hard spots in the welds to spoil cutting tools when machined.

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K-G Welding & Cutting Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.

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NITROGEN
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Smith's Inventions, Inc.
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Hauck Mfg. Co.
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International Oxygen Co.
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Torchweld Equipment Co.
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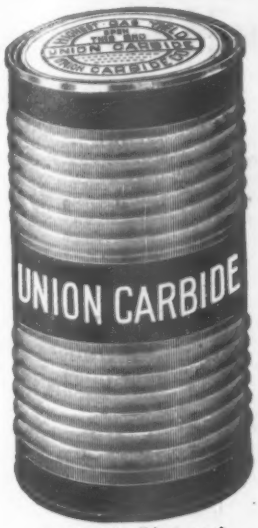

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Sacramento—1523-31 Front St.
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MAINE
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Cumberland—1 N. Liberty St.
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Springfield—Napier St.
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Hancock—First National Bank Bldg.
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Jackson—172 South Water St.
Muskegon—303 W. Western Ave.
Saginaw—1330 No. Michigan Ave.
Sault Ste. Marie.
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Minneapolis—324 N. First St.
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Vicksburg—1312 Washington St.
MISSOURI
Kansas City—1216-1218 W. Eighth St.
St. Joseph—920 S. Sixth St., Sta. "A."
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Albany—Montgomery and Colonie Sts.
Binghamton—21 Jarvis St.
Buffalo—1336 Genesee St.
Geneva—Exchange St. and Railroad Pl.
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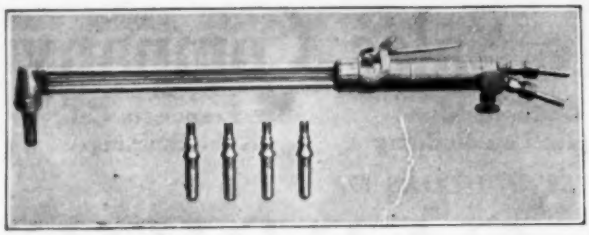

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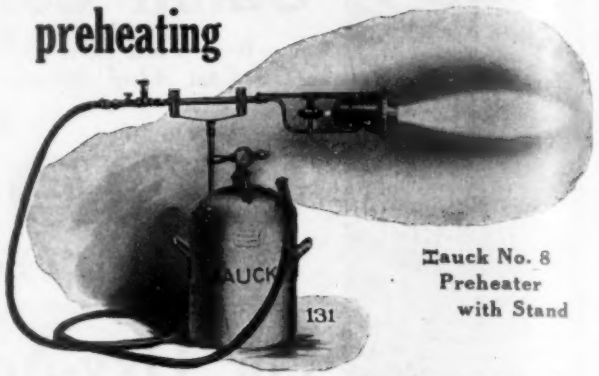

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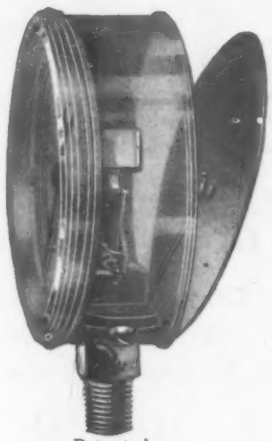

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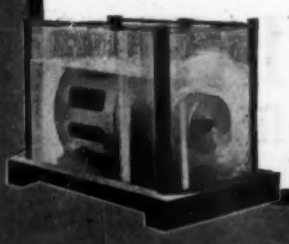

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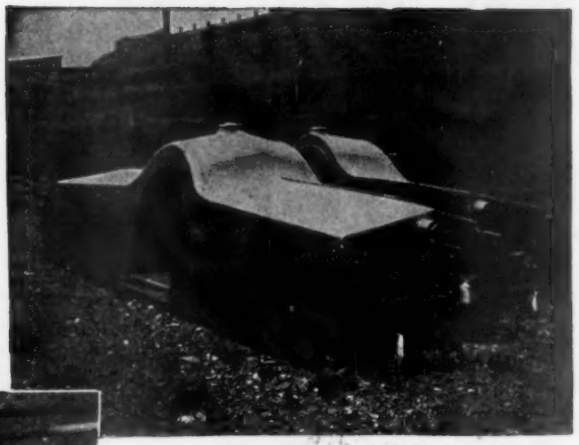
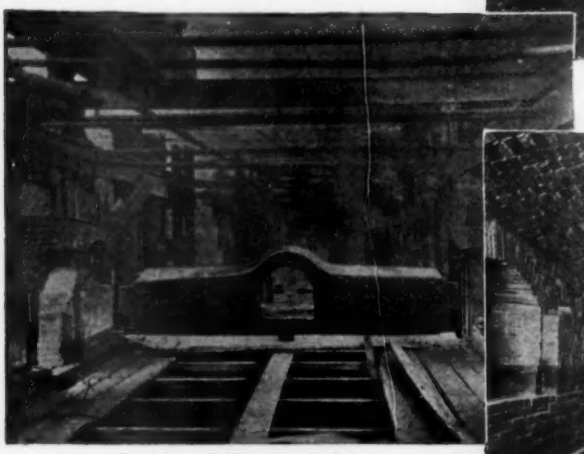
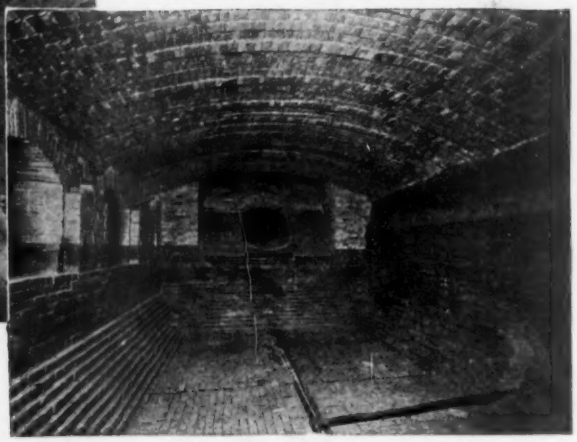


General View of Ports



Interior of Furnace Before Laying Brick



Interior of Furnace After Laying Brick

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Supt. Motive Power.

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The Largest Producers of the Purest Oxygen in the World

"We guarantee to weld up your work at twice the speed and at one half the cost or you may return our welder for full credit."

This was the proposition we made one manufacturer.

We made good—he kept the welder.

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Let us know what you are welding, and we might be able to make you a proposition which business judgment may force you to accept.

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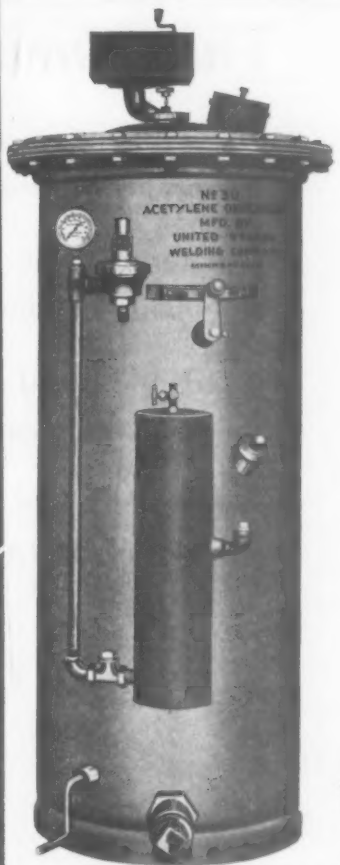

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As much as necessary at 1/3 the cost of tank Acetylene.

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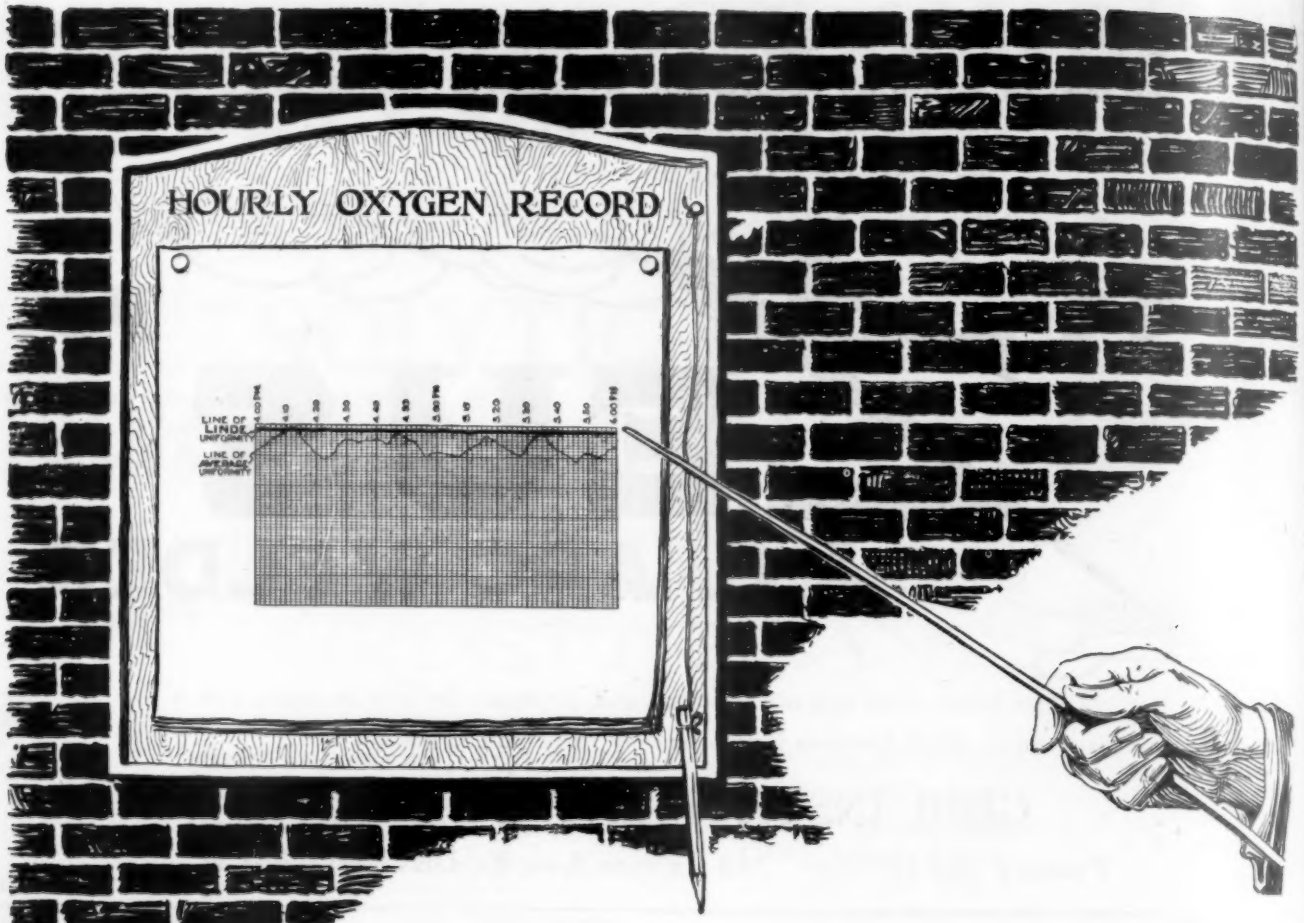

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THE LINDE AIR PRODUCTS CO.
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PROCEEDINGS *of the* AMERICAN WELDING SOCIETY

33 West 39th Street, New York
Comfort A. Adams, President
James M. Morehead, Vice-President.
John H. Deppeler, Vice-President
W. E. Symons, Treasurer ....., Secretary

EXECUTIVE COMMITTEE

C. A. Adams, Chairman	E. L. Mills
J. M. Morehead	Victor Mauck
J. H. Deppeler	D. B. Rushmore
W. E. Symons	H. R. Swartley, Jr.
L. H. Davis	D. H. Wilson, Jr.

MEETINGS AND PAPERS COMMITTEE

L. H. Davis, Chairman	C. A. Adams
F. M. Farmer	J. H. Deppeler
W. L. Merrill	W. E. Symons
E. L. Mills	E. A. Miller, Secretary

MEETINGS were held in Philadelphia, according to program, which resulted in active plans for the organization of a Philadelphia Section. Already 150 applications for membership in this section have come in. A skeleton of the proposed Constitution of the Philadelphia Section is published herewith.

Some of the Cleveland members are confident of being able to organize a Cleveland Section and plans are now being made for this organization. Sections in other active welding centers have been suggested, notably Detroit and San Francisco.

A notice of the meeting of the American Bureau of Welding and of the Research Committee of the American Bureau of Welding on Friday, April 2nd, and a program for discussion is also published. There was to be a joint meeting of the Metropolitan Section of the American Society of Mechanical Engineers and the American Welding Society on April 13th.

The annual meeting of the Society will be held on April 22.

March 29, 1920.

THE AMERICAN WELDING SOCIETY
PHILADELPHIA SECTION
CONSTITUTION

ARTICLE 1
Name

Section 1. The name of this Association shall be the Philadelphia Section of the American Welding Society.

ARTICLE 2
Membership

Section 1. All members of the American Welding Society in or near Philadelphia within the boundaries established by the Society, shall be considered members of the Philadelphia Section.

Section 2. The qualifications of voters at elections shall be the same as are prescribed by the constitution of the Society.

Section 3. Local members may be admitted to membership in the Philadelphia Section as provided in the By-laws of the Society.

ARTICLE 3
Officers

Section 1. The management of the Philadelphia Section shall be vested in a Local Executive Committee of.....members .....of which shall be elected annually, each to serve for.....years.

Section 2. New members of the Committee shall be elected by letter ballot in the month of.....each year, and shall assume office on the..... following, in accordance with the uniform practice of all the sections.

Section 3. The Committee shall select from its membership a Chairman and such other officers as it may consider desirable and shall have full control over the duties and length of service of these officers.

Section 4. The Committee shall select a Secretary who need not be a member of the local Executive Committee.

Section 5. Any member of the Committee who for a period of three months (consecutively) or longer, who does not take part in the management of the affairs of the Section shall automatically cease to be a member of the Committee. The Committee shall have power to fill vacancies in its membership, such appointees to hold office until the next regular election.

ARTICLE 4
Nominations

Section 1. In the month of.....of each year the Section shall nominate candidates of a Nominating Committee of.....members of the Section to serve for the ensuing year beginning..... These nominations shall be voted on in the letter ballot mentioned in Article 3, Section 1, and the.....candidates receiving the largest number of votes shall be declared elected.

Section 2. The Nominating Committee so elected shall prepare the letter ballot for the election of new members of the Local Executive Committee the following year, and shall announce its selections to the Section, approximately and at least one month before the date of sending out the letter ballot.

Section 3. Nominations for new members of the Executive Committee may also be made by petition signed by not less than twenty-five properly qualified members of the Section. The names of such nominees shall be added to the letter ballot as a special list.

ARTICLE 5
Miscellaneous

Section 1. The Executive Committee is empowered to appoint for special purposes temporary subcommittees not restricted as to membership to members of the Section.

Section 2. Propositions for amendments to this Constitution may be submitted in writing at any regular meeting of the Section, and if approved by a vote of a majority of those present at the meeting, shall be submitted to the membership of the Section for vote by letter ballot, and if approved by two-thirds of the votes cast, the amendment or amendments shall become part of the Constitution.

Section 3. This Constitution shall go into effect on.....

AMERICAN BUREAU OF WELDING
WELDING RESEARCH COMMITTEE MEETING
Friday, April 2, at 11 A. M., 33 West 39th Street, New York
PROGRAM FOR DISCUSSION

The first item for discussion will be the restrictions in welding imposed by Lloyd's Register of Shipping, the Boiler Code Committee and the Interstate Commerce Commission.

The Committee is fairly familiar with the welding restrictions of Lloyd's Register of Shipping. In a recent letter from Mr. Cox, he makes the comment that "our position in regard to welding is pretty much the same as it was in 1918. In fact, I regret to say that we have found no good reason to think that the application of the art to ship construction and repair has advanced since that time."

The Boiler Code Committee's restrictions practically bar welding in strength members. In 1914 the Code* contained

*Boiler Code Committee of the American Society of Mechanical Engineers.
†Boiler Code, Sec. 286, p. 45.
‡Boiler Code Appendix, p. 126.

the following, which applies only to forge welding: "Welded Joints. The ultimate strength of a joint which has been properly welded by the forging process, shall be taken as 28,500 lb. per sq. in., with steel plates having a range in tensile strength of 47,000 to 55,000 lb. per sq. in."

In 1918† the following rule was added: "Autogenous welding may be used in boilers in cases where the strain is carried by other construction and where the safety of the structure is not dependent upon the strength of the weld."

Also in 1918‡ the following comments were inserted:

"All calking edges on internally fired boilers may be reinforced by these processes.

"Calking edges of the shells of externally fired boilers above the fire lien only, may be reinforced.

"Cracks extending from edge of lap to rivet, except on seams below the fire line in externally fired boilers, may be welded.

"Cracks not exceeding 30 in. in length in back connection sheets, wrapper sheets, bottoms of combustion chambers, heads, and other stayed surfaces may be repaired by welding.

"Where cracks are repaired by welding, holes shall be drilled entirely through the plate at each extreme end of the crack, except in small cracks from rivet to calking edge.

"Circumferential or lengthwise cracks not exceeding 16 in. in length in plain or corrugated furnaces may be welded.

"Where plates in back sheets of back connections, wrapper sheets of sides and bottoms of back connections of any boilers, side sheets and legs of furnaces and bottoms of furnaces of fire box boilers, and other stayed surfaces are reduced in thickness not exceeding 40 per cent of the original thickness, they may be reinforced, such reinforcing not to exceed an area of 200 sq. in. in any one plate.

"When such reinforcing extends over stays and braces such stays and braces shall come completely through the reinforcing so as to be plainly visible to the inspectors.

"When the corroded portion of stayed or riveted surfaces of the back sheets or wrapper sheets or bottoms of back connections of any boilers, or side sheets and bottom sheets or furnaces or legs of fire box boiler exceeds 300 sq. in., the same may be repaired by the removal of the corroded portion and the replacement thereof by a new piece of plate, the edges of the new plate being welded in position.

"Staybolts, braces, or rivets shall pass through the body of the new plate as before, the area of the new piece not to exceed 24 by 24 in., or 30 in. in any one direction, the welded edges to be V'd or beveled along the joint prior to welding.

"Where plates of shells and other parts of internally fired boilers subject to tensile strain are reduced in thickness by corrosion not to exceed 25 per cent of the original thickness, they may be reinforced, such reinforcing not to exceed an area of 200 sq. in.

"Where calking edges and laps have been reinforced, local inspectors shall require the rivets to be cut and redriven if they find by inspection that it is necessary.

"No welding shall be allowed in cracks in the shell plates or other plates subject to tensile strain.

"Cracks extending through rivet holes in single-riveted or double-riveted seams in stayed surfaces of back connections of any boilers or side sheets of legs or bottoms of fire-box boilers which are stayed surfaces may be welded up to a length of 6 ft. exclusive of rivet holes.

"Where cracks extend through rivet holes in stayed surfaces, the piece extending from the rivet to the edge of the lap may be removed where convenient to do so, and the place where the piece has been removed may be replaced by being built up and reinforced by either of these processes.

"Where leaks developed around staybolts are otherwise intact, the nuts may be removed from the ends of the staybolts, and the staybolts may be welded into the shell by welding a beveled collar or ring around the staybolt. The width and depth of such collar shall equal one-half of the diameter of the staybolt. In all such cases of applying welding rings or collars around staybolts the material shall be hammered while in a glowing state as it is applied.

"In all cases where metal is deposited on stayed surfaces, the operator shall hammer, when practicable, the deposited metal while it is in a glowing state.

"Cracks in wrought-iron or wrought-steel headers, and cracks or sand holes in cast-steel, semisteel, ferrosteel, malleable-iron or cast-iron headers, manifolds, crosses, tees, and ells may be repaired by welding cracks or flowing metal into sand holes. Such repaired metal other than headers and manifolds shall be subjected to a hydrostatic test of three and one-half times the working pressure after such repairs are made. Reinforcing by building up of any of the the above-mentioned articles other than headers shall not be allowed."

A recent report§ of A. G. Pack, Chief Inspector, Bureau of Locomotive Inspection, Interstate Commerce Commission, brings out strongly the point that when failures occur in locomotive fire boxes, due to low water, the results are more serious with welding than with riveting. The difference seems to be that welding gives way suddenly, while the riveted failure occurs more slowly, letting down the steam pressure with less serious results.

In advancing welding the great object must be to prevent failures due to its application to parts for which it is not suitable at the present time. It is important, therefore, either to accept these restrictions or to establish the conditions under which the use of welding may be safely extended.

One of the prime requisites for extending the use of welding is a uniform system of training welders, which is the second item for discussion. There seems to be no reason why the Committee should not now come to an agreement on practically all the essential factors of this question.

March 18, 1920.

To the Members of the American Bureau of Welding and the Welding Research Committee:

As the situation relating to the formation of a Philadelphia local section of the American Welding Society made it necessary to hold a meeting of the Directors of the Society on Friday, April 2nd, it seemed advisable, in order to conserve the time of the members, to hold the regular Welding meeting on the same date instead of on the fourth Friday in March, which is the regular date. Therefore, there will be a meeting of the American Bureau of Welding and the Welding Research Committee on Friday, April 2nd, 1920, 11:00 A. M., 33 West 39th Street, New York.

The business to come before the **Bureau** will be as follows:

The consideration of a proposal to reduce the representation of the American Welding Society in the American Bureau of Welding. This reduction will involve a change in the By-Laws, an amendment to which requires thirty days' notice before presentation at a meeting.

The business to come before the **Welding** Research Committee will be:

1. The discussion of the restrictions in welding imposed by Lloyd's Register of Shipping, the Boiler Code Committee and the Interstate Commerce Commission.

2. Preparation of a definite recommendation to the Bureau for uniformity in training of welders.

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§For the year ending June 30, 1919.

A program for the meeting, explaining in further detail the subjects for discussion, will be forwarded later.

Yours very truly,

C. A. Adams, Director.

To the Members of the American Welding Society:

The Directors have set APRIL 22ND as the date for the ANNUAL MEETING of the SOCIETY, which will be held at the ENGINEERING SOCIETIES BUILDING, 33 West 39th Street, New York City, at 10:30 A. M.

Some time before this meeting it is necessary to elect a President, one Vice President and eight Directors.

ARTICLE III, Section 2 reads

The President shall be elected by the Society for a term of one year, and shall not be eligible for immediate re-election to the same office.

ARTICLE III, Section 3 reads

At the first meeting the Society shall elect two Vice Presidents, one to serve until the annual meeting in 1920, and the other to serve until the annual meeting in 1921, as designated by the Nominating Committee; and at each annual meeting thereafter the Society shall elect one Vice President for a term of two years. Vice Presidents shall not be eligible for immediate re-election to the same office.

ARTICLE III, Section 5 reads

At the first meeting the Society shall elect twenty-four Directors, eight to serve until the annual meeting in 1920, eight to serve until the annual meeting in 1921, and eight to serve until the annual meeting in 1922, as designated by the Nominating Committee, and at each annual meeting thereafter the Society shall elect eight directors for a term of three years.

ARTICLE III, Section 7 reads

Subsequent elections of officers of the Society and the nominations therefor shall proceed as follows:

Any member or group of members, except Class C and Class D members, may send to the office of the Society nominations for officers. These nominations must be received by the Secretary at least sixty days prior to the annual meeting.

From the nominations so received the Board of Directors shall indicate its choice. All nominations, with the Directors' choice indicated, shall be sent to all members entitled to vote, who shall vote thereon by letter ballot.

The enclosed Prospectus shows the present officers and their terms of office.

The Secretary and Treasurer are appointed by the Directors.

Very truly yours,

H. C. Forbes.

Outline of Mr. J. H. Deppeler's Talk on Thermit Welding at the Meeting of the American Welding Society in Philadelphia on January 23rd, 1920.

At the meeting of the American Welding Society in Philadelphia on January 23rd, 1920, J. H. Deppeler, Chief Engineer of the Metal and Thermit Corporation, gave a talk, illustrated by moving pictures, on a Thermit repair of the stern post of the U. S. Army Transport "Northern Pacific" which had been broken when this vessel ran aground on January 2nd, 1919, in a dense fog off Fire Island, N. Y.*

For the benefit of the uninitiated, Mr. Deppeler first described the Thermit reaction. Thermit, it was explained, is a mixture of metallic aluminum and iron oxide and other minor ingredients to subsequently form a steel. This mixture, when ignited by suitable means, reacts, the iron being reduced to the metallic state and the aluminum oxidized to alumina (aluminum oxide). The amount of heat involved by the reaction is so great as not alone to melt the steel and slag (alumina) produced, but to superheat them much above the melting point, in fact to about 5,000° F. The reaction is performed in a crucible which is tapped from the bottom immediately upon completion of reaction. The duration of a reaction is only from 30 to 60 seconds, according to amount of Thermit needed for weld, the molten steel and slag meanwhile separating by reason of their difference in specific gravity; the steel naturally lying at the bottom of crucible and, therefore, flowing out first upon tapping. This Thermit steel is sufficiently hot to melt into any metal with which it comes in contact, and amalgamate with it to form a solid, homogeneous mass when cool.

In making welds by the Thermit process, the parts to be united are surrounded by a sand mold, a small cavity being left around the ends of the parts. This cavity is formed by modeling wax around the fracture prior to ramming the sand, the wax being melted out at beginning of subsequent preheating. Suitable gates and runners are left in the sand mold for preheating and pouring. The ends of the parts to be united are then heated red hot by means of a special preheater, after which the Thermit steel is tapped from the crucible into the mold.

The purpose of the preheating is threefold: (1) to dry the mold, (2) to facilitate amalagamation of the Thermit steel with the ends to be joined by raising the temperature of the latter, and chiefly (3) to introduce cross-sectional (transverse) expansion into the ends to be joined and thus obviate internal strains upon cooling. The longitudinal contraction can readily be taken care of by other means.

The stern post of the "Northern Pacific" had been broken just above the uppermost gudgeon where its solid section began to develop into an inverted, hollow, triangular, truncated, pyramid. The fracture was approximately in the form of an equilateral triangle with sides 24 inches long; the portion below the fracture being solid, while the upper portion was hollow, with walls 3 inches thick. To effect the weld, 1,400 lbs. of Thermit were used, producing by its reaction something over 900 lbs. of Thermit steel.

Mr. Deppeler pointed out how Thermit welding differs from the other forms of welding (oxy-acetylene and electric) in that the entire weld was made at one time, and therefore, impurities readily floated to the surface; also that there was but one shrinkage to allow for, thus making the process more useful on heavy repairs than the other processes. He also pointed out that the three processes in his estimation had very distinct fields overlapping a very slight extent only.

*A detailed and illustrated description of this repair wa spublished in The Welding Engineer for August, 1919.

LOCAL CHAPTERS

It is the plan to organize local chapters of the American Welding Society, in suitable cities, just as fast as possible. These chapters will be organized under a charter granted by the parent body, and to a certain extent under the direct jurisdiction of the National Officers, to the end that we may have a **homogeneous, welded** organization, whose collective strength and unity of purpose will furnish the power we need to advance the cause of welding.

In organizing Local Chapters, it is desirable that each Chapter affiliate with a local **general** Engineering Society, which would not only provide a suitable place of meeting, but would also enlist the interest and attention of engineers of standing.

We understand the American Welding Society has drafted a plan of organization for Local Chapters and is prepared to confer with members of the trade relative to organizing in every locality. In fact, a National Organizer will be furnished to assist Local Chapters in getting started. Correspondence should be addressed to the American Welding Society, 33 W. 39th St., New York.

BLOWPIPE MANIPULATION

*A New Method of Executing Welds**

Defects in Welds Done by Beginners.—If the weld is badly executed, as is common with beginners, its general appearance is irregular. The surface does not consist of a series of overlapping ripples all practically in the same plane, but consists, as a section along the line of welding will show in Fig. 10, of a series of hills and valleys.

The most serious defect with beginners is to form a channel on either side of the weld throughout its length, these channels, shown in Fig. 11, being below the surface of the plate.

These channels not only weaken the whole length of the

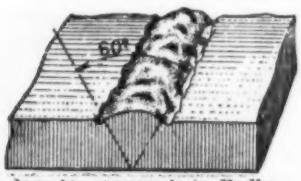


Fig. 11. Channels in Badly Executed Weld.

Fig. 10. Badly Executed Weld.

weld along each side, but are the starting points of cracks, as is proved by bending tests on welds containing this defect.

With a little experience a welder soon reaches the stage in which he eliminates these irregularities and defects. We have proved by a wide range of tests that a welder who has not previously welded backwards does not require much practice before he obtains excellent results.

Characteristics of Well Executed Welds.—The welds are very regular in appearance and are not so wide as the welds done by the ordinary method. No channels which correspond to a thinning at the edges of the welds are present. There are no hollows or excess addition of metal on the surface. The under side of the weld shows that the fusion has been complete throughout the thickness of the metal, in other

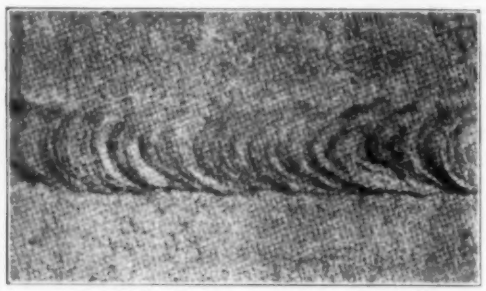


Fig. 12. Full Size Photograph of a "Backward" Weld on 3/16-inch Plate.

words the penetration is complete and there is no starting point for cracks.

Examination of Welds, Results of Tests and Industrial Results.—The following observations made during the examination of welds executed by this new method of welding, accompanied by the results of the first series of tests will conclude this first study. Some notes on the industrial results obtained over a period of eighteen months are also included.

*By Capt. D. Richardson in Acetylene and Welding Journal, London. Previous installments were published in the February and March issues.

It is incontestable, from the point of view of good penetration of the metal and the absence of the defect of adhesion, that welding backwards offers considerable advantages over other methods of executing welds and is capable of entirely eliminating these defects.

Etching tests on welds obtained by the new method show perfect joining between the metal of the plate and the added metal. The welds show distinctly less oxide inclusions than those obtained by the ordinary methods, and are free from blowholes. In addition they possess ordinary hardness and the remaining mechanical properties are more regular.

Bending tests have given good results. It is possible to fold the weld without starting a crack which is a very good indication of excellent elongation properties and good penetration of the weld. The tensile strength of the weld is also greater than that of ordinary welds and improvement in the other mechanical properties is obtained.

A series of welds made by welding backwards, have been obtained from various works carrying out commercial oxy-

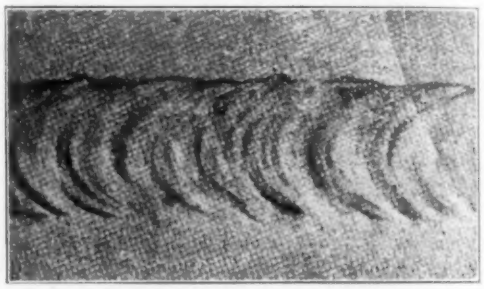


Fig. 13. Full Size Photograph of a "Backward" Weld on ⅝-inch Plate.

acetylene welding and although we are not permitted to give the results obtained by testing, they are all favorable to the new method. Extremely favorable results have been obained in Italian workshops.

From the point of view of instructing welders, there is no doubt that apprenticeship need only be brief as when the fundamental principles are well understood rapid progress is made. We have shown that after a very short period of instruction a beginner can produce welds free from the defect of adhesion, and the burning of the metal, with good penetration and good joining of the metal.

In the construction of projectiles, shells and bombs, by oxy-acetylene welding, the percentage of leaks, or rather sweating, in one workshop, when the welds were placed under hydraulic tests was 15 to 16 previous to the introduction of the new method of welding. This figure was reduced to 4 per cent and was practically eliminated at the point where leaks were common, namely, at the junction of the circular and longitudinal welds, but it was found necessary to instruct workmen to give a little more attention to making the junction of welds. In the case of aeroplane bombs the reduction in the percentage of leaks was of the same order after the new method had been applied. Hydraulic tests to destruction demonstrated the good quality of the welded joints.

Comparative tests made under practically the same conditions showed a gain of 6 per cent in elongation for mild steels executed by the new method.

The following figures relative to the increase in the speed of welding, with a consequent economy in gas and labor, bear out the previous statement that the gain is in the neighborhood of 30 to 35 per cent. In repetition work an average welder executed 54 feet of ⅜ inch plate in 10 hours, practically 5½ feet per hour, which can be considered as an excellent output, by the ordinary method of welding. The same welder, welding backwards, executed almost double this quantity, namely 98 feet in 10 hours, almost 10 feet per hour.

In analogous work, but on ⅛ inch plate, the output for numerous welders varied between 210 to 310 longtudinal cylindrical seams, each about 9 inches long, and the welds were free from defects such as pinholes, etc. These results were duly checked by the secretary of the French Acetylene Association.

In conclusion the process of welding backwards should appeal to all firms who are out for economy in the execution and improvement in the quality of their welds. It is only necessary to emphasize that common sense is necessary in applying the methods on the lines which have been outlined in these articles.

D. R.

TRAINING WELDERS*

In Canada we train our own operators today. There is a school which is run either by the Government or some college institution where welding lessons are given and after a dozen of these lessons they turn out what they call a first class welder. In France, where they have it down to a science, they take young boys from 16 to 18 years of age and send them to a technical school where they are taught all about oxygen and acetylene. These boys are given a mechanical training and they give them a highly technical training as well. When they come out of this school they know the theory of it down to perfection and they are then apprenticed to a first class welding works for a period of four years; in other words, the French government claim that these oxy-acetylene welders are entitled to a first-class welder's certificate which enables them to do any kind of oxy-acetylene welding. These boys have to put in eight years learning the trade. I can take a laborer and teach him how to cut in two or three days. Anybody can do the same if he has been told how to light his torch and apply the oxygen. Any ordinary laborer can be shown in a few minutes how to cut up steel scrap or old boilers, etc., and in three or four days can learn how to do this class of work, but the French Government claim that it takes eight years to make a first class oxy-acetylene welder. In England there are similar schools run by the Government and there is the British Welding Association, which is working along the same lines. I think the term of apprenticeship is as long as it is in France. Today in Canada a boy goes up to the technical school and gets eight or ten lessons and he is then a first class welder. He goes into the welding shop and makes a lot of noise, but when he comes to do the work he gets a black eye. The result is that all large welding works train their own men. The Soldiers' Civil Re-establishment are undertaking to teach the men to become welders in eight months, and while they get along fairly well, it is impossible to learn this trade in that time, although they may be able to handle certain repetition work very nicely. A first class man, however, should be able to weld any kind of metal and any combination of metals. There is no limit to what he is asked to do. Today he works on a brass casting, the next day it is an aluminum crank case, and the next day he tackles big cast iron castings which will take 100 pounds of metal to make the weld. On the other hand, repetition work can be learned very easily. During the war several shops in France had over 500 operators working at one time, and one shop had over 1,200 working at one time, and most of these operators were women who had been at the work for only a couple of months making up bombs and depth bombs. It was simply a case of repetition work. The French Government had a lot of apprentices to show the women how to do the work and in a few days they could do it very well, according to results.

Someone has made the statement here tonight that they had no faith in oxy-acetylene welding of cast iron. I may say that I am not interested in processes or apparatus. We are a welding concern pure and simple, and we do not care how we do the job, but use the best process for the job. At least 90% of the work that comes to us is cast iron and 97% of that work is done by the oxy-acetylene process. It comes to us in all sizes, shapes and conditions, from little castings weighing a few pounds to castings weighing several tons. When we get through here tonight, we are going to go down and tackle a big cast iron job by the use of Thermit welding. If any of the gentlemen here want to see this work, we shall be glad to have them come along. It will take place about two o'clock tomorrow morning. As I said before, 97% of our cast iron welds are made with the oxy-aceteylene process and our failures are less than one-tenth of one per cent.,—so I think we can get back and look at the operator and not the process. If a job fails in an industrial shop, the operator is never wrong—his gauge, or his oxygen or the acetylene is not right or the rods from the stores are wrong, but he is never wrong. With us who do welding commercially, it is different. If we make a failure we not only get a black eye but we do not get paid, and we find out what is wrong. Excuses do not get by. If the weld fails, it is up to the opeator and no excuses are accepted. It is a poor workman who quarrels with his tools, generally. I think this is an answer to the point which came up tonight.

We have some cast iron jobs coming into the shop from time to time which are welded by electricity, but they are freaks pure and simple, and are not commercial jobs. The method of welding cast iron by electric welding is to open the break in the usual manner and put studs into the "V," then fill it up with a mild steel welding rod by the electric process. You are not welding cast iron by the electric process. You are welding steel on steel studs and when the added metal is put under a microscope, we find there is a distinct line of slag between the added metal and the cast iron. There is a flux some works use which assists in breaking up the slag, but the results are very indefinite, and commercially we always use the oxy-acetylene process for cast iron where the jobs are ordinarily small, but in large sections it is best to use Thermit.

At the National Railway Appliances Association Exhibit, Coliseum, Chicago, March 15th to 18th, the following concerns exhibited: Air Reduction Sales Co., U. S. Light & Heat Corp., Carbic Mfg. Co., Oxweld Railroad Service Co., Torchweld Equipment Co., National Carbon Co., General Electric Co., Page Steel & Wire Co., Squire-Cogswell Co. (representing Hauck Mfg. Co.), Alexander Milburn Co., Wm. Wharton Jr. & Co., and the Steel Sales Corp.

*Extracts following the discussion of a paper on welding read before the Canadian Railway Club. The author of the above remarks is Mr. A. M. Barry, Managing Director, St. Lawrence Welding Co., Ltd., Montreal.

WELDING A HIGH-PRESSURE CYLINDER

By FRANK H. FRYE

This engine, type, "Mallet" Articulated Class AE, the largest locomotive built, was delivered to the Virginian Railroad by the American Locomotive Works, and placed at a hill division in pusher service. Due to too much water in boiler the left high-pressure cylinder was badly broken. Upon being stripped and inspected, the cracks were found to be fourteen feet in length on barrel of cylinder and valve chamber, including three internal breaks in exhaust chamber.

The "shop officials" of the Virginian Railroad and a representative of the American Locomotive Works thought it was impossible to weld this cylinder with the Oxweld process. Accordingly, requisitions for a new cylinder were made, but as the American Locomotive Works had none in stock a delay of twenty-two days would have ensued before one could have been cast and delivered. The superintendent of motive power, wishing to avoid the delay and the large expense connected therewith, consulted an Oxweld Acetylene expert, and was assured that the job could be welded satisfactorily.

The operation was carried on as follows: The cracks were cut at an angle of forty-five degrees. In order that the operator might get at internal breaks in exhaust chamber, a patch had to be removed from the outside wall of the cylinder. (When the internal cracks were welded this same patch was welded back in the outside wall.) A furnace of fire brick was built around this cylinder and heated with charcoal to a cherry red heat, heat being kept uniform during the process of the welding operation.

The cost of operation was as follows:

Removing guides, front and back cylinder heads, jacket	$ 3.00
Chipping and drilling cylinders and cutting out cracks	34.00
Building furnace, labor	7.00
Heating cylinder, labor and material	16.00
Cost of Oxygen and Acetylene:	
No. 8 welding head, 8 hours @ $0.65 per hour	3.91
No. 10 welding head, 13 hours @ $1.00 per hour	13.00
No. 12 welding head, 21 hours @ $1.26 per hour	26.65
160 pounds of cast iron filler rods, @ $0.15 per pound.	24.00
3 pounds of cast iron ferro flux, @ $1.00 per pound	3.00
2 welding operators, 40 hours each, @ $0.68 per hour.	54.00
Boring cylinder after welding, labor, 10 hours, at $0.68 per hour	6.80
Helper's labor, 10 hours, @ $0.45 per hour	4.50
Labor cost, hanging guides, putting in piston, cylinder heads, cylinder cock rigging, hydrostatic test on cylinder, machinists, 17 hours, @ $0.68 per hour	11.56
Helper with machinist, 17 hours, @ $0.45 per hour	7.65
Total cost of operation	$215.97

Fig. 1. Patch Removed to Get to Cracks and Exhaust Chamber.

Fig. 2. Cracks on Front of Cylinder at Each Side of Steam Port and on Cylinder Head Joint.

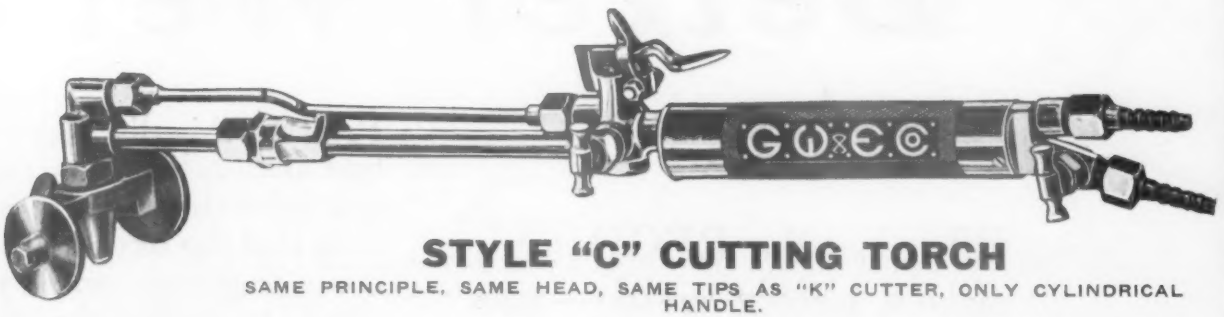
Fig. 3. Breaks on Barrel of Cylinder and Valve Chamber.

(Continued on Page 32)

GENERAL WELDING & EQUIPMENT CO.
G.W.&E.C.
107 MASS. AVE. BOSTON, MASS.

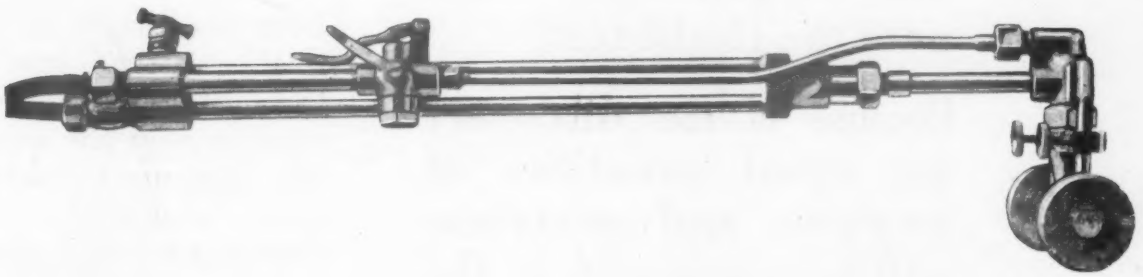
THE FAMOUS "K" CUTTING TORCH

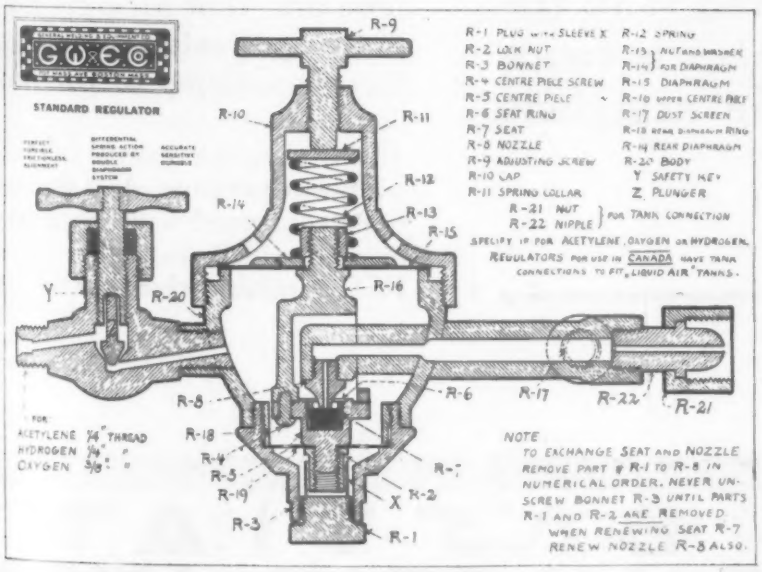
MANY THOUSANDS OF THESE CUTTING TORCHES ARE IN CONTINUOUS USE IN THE U. S. AND CANADA



STYLE "C" CUTTING TORCH

SAME PRINCIPLE, SAME HEAD, SAME TIPS AS "K" CUTTER, ONLY CYLINDRICAL HANDLE.





DOUBLE DIAPHRAGM REGULATOR

MOVABLE CENTREPIECE R-16 CARRYING SEAT R-7 IS NOT ONLY FASTENED TO MAIN DIAPHRAGM R-15 BUT ALSO TO PERFORATED REAR DIAPHRAGM R-19 THUS ENFORCING AN ABSOLUTELY STRAIGHT AND FRICTIONLESS UP AND DOWN MOVEMENT OF SEAT R-7. REAR DIAPHRAGM R-19 ALSO ACTS AS A SENSITIVE DOUBLE WAY SPRING, THUS INCREASING SPEEDY ACTION OF MAIN DIAPHRAGM R-15 AND PREVENTING IT FROM BEING OVERSTRAINED AND FROM BUCKLING.

NO OTHER REGULATOR HAS THESE REMARKABLE FEATURES.

WELDING AND C

Better Weldi

Why does the **REGO** torch make **a better weld — use less oxygen** — and **eliminate the flashback?**

Because of the **discovery** that **equal quantities of oxygen and acetylene will be consumed if the oxygen conduit to the mixing chamber is twice as big as the acetylene inlet.**

Prior to this discovery, oxy-ac had always been constructed w gen inlet should be **small** and t —so that the oxygen would, at t come together—speed up the would be greater than the back

Sounds all right on paper BUT flashes easily. Just bring the h the molten metal and BANG! speeding up the mixed gases b gen pressure would seem to be

Remember, too, that the oxy **consume exactly equal quantit lene** and that all oxygen in ex not only **wasted** but enters the as an oxidizing or burning age

If the oxygen pressure is two, three acetylene pressure, does it sound rea tities consumed will be equal? Isn't oxygen will be in excess in volume REGO mixing chamber so proporti

THE BASTIAN
WEST AUSTIN AVENU

TING APPARATUS

at Less Cost

ways carrying the oxygen and acetylene that the acetylene comes through the areas half the size of the oxygen conduit and at a slightly higher pressure.

This principle dams (or holds back) any more oxygen coming through than the exact quantity necessary for the first stage of combustion, which is exactly equal volumes.

This principle eliminates the flashback; for each time a flashback is imminent, **the acetylene shuts off the oxygen** completely or partially and as acetylene alone won't burn and because the backward flame propagation of a "rich" mixture is less than a "lean" mixture, **the REGO torch won't flashback.**

An equal pressure torch cannot do this. A torch using the oxygen under a higher pressure cannot. The acetylene pressure **at the mixing chamber** must be greater than the oxygen so that the oxygen is dammed or shut off—**that's the REGO principle.** That principle is protected by U. S. Patent 1,301,044.

There isn't any logical reason why you should continue to use an excess of oxygen (which you pay for) harmful to good welding and be annoyed by flashbacks which are ruinous to successful welding.

A trial in **your** shop will prove the advantages of the REGO principle.

SSING COMPANY
LA SALLE STREET ✕ CHICAGO.

(Continued from Page 28)

Cost of new cylinder would have been as follows:

Cost of new cylinder, less scrap credit	$1,700.00
Locomotive out of service 22 days at an earning capacity of $127.00 per day	2,974.00
Cost to remove broken cylinder, taking down pipe, by-pass valves, removing saddle bolts, fitting new bolts, hanging new cylinder, putting up guides, cylinder cocks, jacket, pistons, cylinder heads, casings, tallow pipe, running boards and brackets	160.00
Total cost of applying a new cylinder	$4,654.00
Total cost of welding operation	215.97
Grand total savings by welding process	$4,439.03

Since the above operation this engine has stood the test of fourteen months of very hard service.

In the construction of the prevailing furnace, fire brick was used and laid up with fire clay and so arranged that two bricks at a time could be removed following the line of breaks in cylinder. The base was laid, to keep from burning the floor of the shop, in fire clay, openings being left for draft, and for replenishing cylinder with fuel. This fuel was placed in a grating six inches above the base of the furnace to heat the bottom of the cylinder. The fuel was then placed in the bottom of the cylinder proper, netting was placed across the center of the cylinder on the inside and fuel laid on top of the netting. This heated the top of the inside of the cylinder. Fuel was then placed in the bottom inside the valve chamber. Netting was placed in center inside the valve chamber and fuel applied to heat the inside top wall of valve chamber.

The fire was first lighted at the extreme bottom of cylinder, expanding the cylinder from the outside and at the bottom. The fire was next lighted in the barrel of the cylinder, enabling us to get our heat up gradually before attempting to light fuel in the valve chamber. Four hours time was consumed in heating this cylinder. I find that it is necessary to carry out this heating operation slowly, as too sudden a heat might cause other cracks to occur. After cylinder was brought to a low cherry-red heat, welding operations were started at the line of break shown in sketch (at the front cylinder head joint), following the line of break around the side of the cylinder and progressing upwards at all times until the weld was completed at the extreme top of the valve chamber.

The second weld was started on front cylinder head joint next to the frame and welded in an upward direction to the wall where the patch was removed.

The third weld was started in the exhaust chamber, welding through the opening, which was made by cutting out the patch, as shown in the sketch.

After internal cracks were welded, patch was replaced, welding the perpendicular openings first, starting at the bottom and welding upwards at all times. The bottom opening of patch was welded next, starting at the right hand corner and welding to the left. The top opening of the patch was welded last, welding from right to left.

The cylinder was kept at a low cherry-red heat at all times during the welding operation, thus insuring all expansion relieved. When weld was complete, fuel was added at the base, in the barrel of the cylinder and in the valve chamber to insure a general heat, making contraction conditions uniform. All openings in furnace were then chinked, making it as tight as possible, thus allowing a slow cooling process, which is very necessary.

The furnace was lefting standing until the cylinder was absolutely cool, thus insuring a soft condition of the metal, which can be readily machined where necessary to do so.

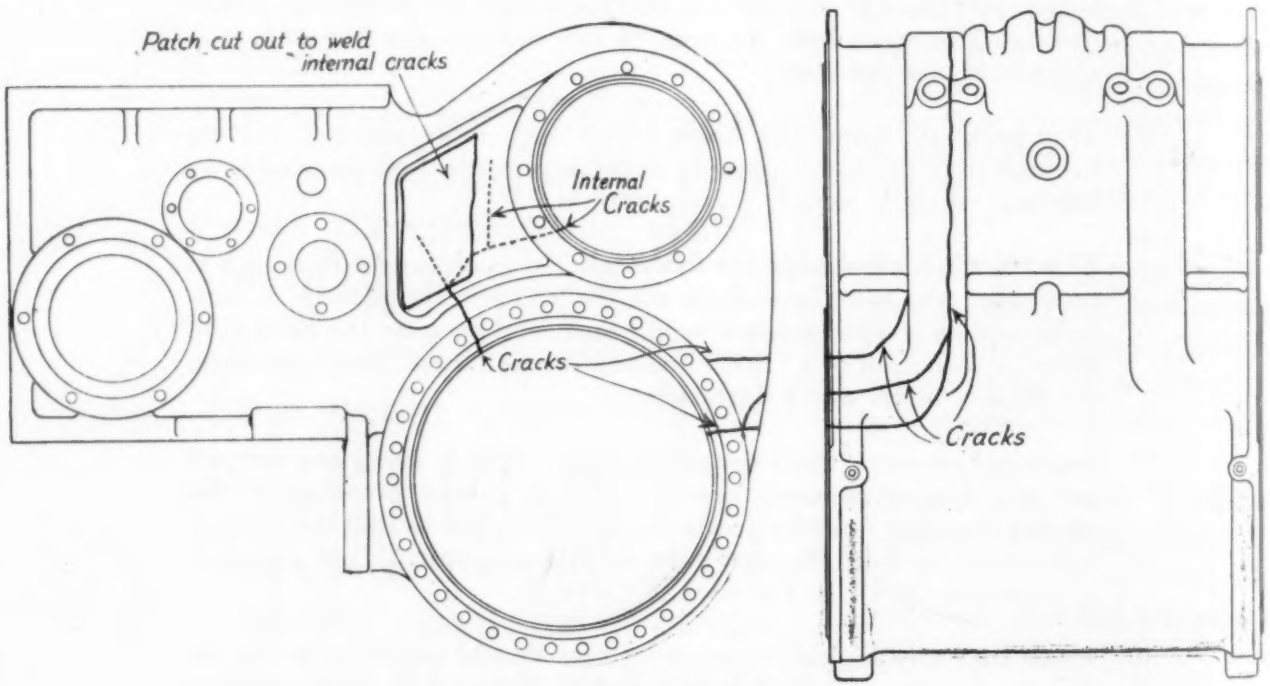


Fig. 4. Fourteen Feet of Cracks

SCORED CYLINDERS

Scored cylinders must be hot in order to make a good smooth job. The following may be an old stunt, but may be some of the brothers have not heard of it: When welding an old stove or furnace grate or boiler of cast, use salt with the flux and twice a ⅛ Norway filler around the cast filler and the job will be first class. Well, here is hoping we hang together and build up the craft.

R. H. Anderson, Brookings, S. D.

"What You Doing Now, Jake?"

"I am in business for myself. I have started in that Welding Shop that I have been talking about. Last fall I found just the place that I wanted; all kinds of welding work around and no one to do it. People fairly begged me to start in. At that time, I couldn't do it because I didn't have the money. I had an idea it took two or three thousand dollars at least to start in any kind of a shop at all. One day I happened to run across a fellow who knew about the Electric Arc Cutting & Welding Company, of Newark, N. J. He told me about their machine and said it was a dandy, didn't cost very much at all in comparison with the other machines. He told me too that if I wrote them that they might make me some kind of a proposition, letting me pay for it as I went along.

"Well, I wrote these people, told 'em about the place that I had in mind, business I thought I could do, what money I had to do with, and a whole lot of things about myself, so that they could get acquainted with me. I got a letter back saying that they were willing to help me out. After we had made arrangements, they gave me advice as to how I should run my business, what prices I should charge, how I should advertise, so that all I had to do was to follow directions and keep on the job and take care of the money as it came in. They have it all doped out for you.

"The best thing for you, Jake, if you want to start in business, is to do the same thing I did. You'd better write these people, tell them just what I told them. I'll bet they'll help you out and get you started. Why, I know of several cases where they helped young fellows to start in. You'd better write today, before you forget it."

I happened to hear this conversation and it occurred to me that there might be men who wanted to start a welding shop and did not know that we could and would help you in getting started.

I'd like to know you, and have you know me. Just regard me as a personal friend and write me all about yourself and your idea for your own welding shop.

E. S. HURD

Electric Arc Cutting and Welding Co.

222 Halsey Street, Newark, N. J.

The Welding Engineer

Reg. U. S. Pat. Office.

Published on the 15th of Each Month by

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VOLUME 5. APRIL, 1920. NUMBER 4.

Increased Subscription Rates

FOR the past three years the cost of doing business in the publishing field has been mounting higher. Today publishers are paying four times as much for printing and paper as they were three years ago—and the end is not yet. Salaries and other general expenses have also increased. *The Welding Engineer* has attempted to meet these rising costs by increasing advertising rates from time to time, but we have now reached the point where an increase in subscription rates is necessary. Effective April 15th, therefore, the subscription rate to *The Welding Engineer* in the United States, Canada, Mexico, Cuba and our possessions will be $3.00 per year. Abroad, the rate will be $4.00. For our part, we hope to make *The Welding Engineer* more useful and instructive and we hope our readers will recognize the necessity of this increase.

The American Welding Society

THE Board of Directors of the American Welding Society is largely composed of gentlemen who are connected with manufacturing and supply companies. The point has been raised that this is not as it should be—that **users** and not **makers** should rule the Society.

To our knowledge, a number of very useful Engineering and Scientific bodies have been organized by manufacturers, who furnished the necessary funds, performed the hard task of organizing and perfecting the organization, later turning over the active management to the **users.** These manufacturers are usually found in the ranks of the Associate Members and still contribute much to the Associations in question.

We are of the opinion that the manufacturers of welding equipment and supplies would be very glad to stop down and out and permit the welding Engineers to run the American Welding Society—if there was a sufficient number of them in the Society to do so. Until the Society has passed out of the toddling period, we think such criticism as we have referred to is to no purpose.

The Degree of Welding Engineer

THE WELDING ENGINEER recently advanced the idea that it would be perfectly feasible for our Engineering Schools to prepare such a course and turn out young engineers who would know a great deal about welding. One of our practical friends says we are all wrong—that what we need most is some **plain welders.** A couple of our leading Engineering Schools also fail to approve of the idea.

C. R. Richards, Dean and Director, College of Engineering, University of Illinois, says in response to a letter on this subject:

"I have read with interest your letter of March 3. In the courses in our Shop Laboratories, which are designed to train engineering students in the principles of shop management and of manufacture, we give some demonstrations and instruction in various welding processes, including oxyacetylene thermit, and hand processes. In view of the fact that this is not a trade school, and that we are not seeking to train men for a particular calling but rather to train them to be responsible as leaders in industrial work, I would not look with favor upon the extension of highly specialized instruction, such as you propose, in the college curriculum. Intensive training in various methods of welding would, of course, be very proper in trade or vocational schools.

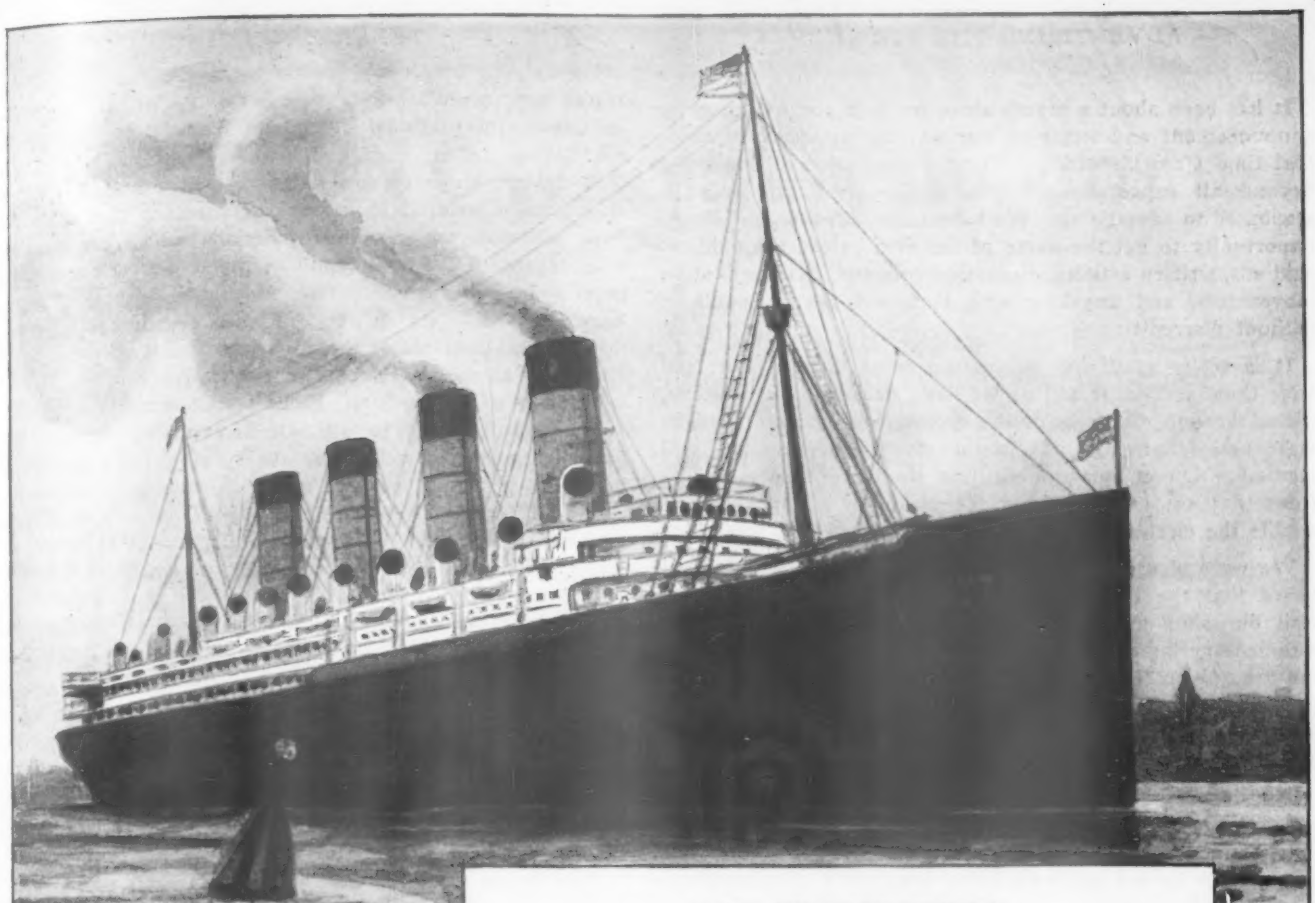
There is great danger of over-specialization in our engineering colleges. We have requests to give specialized training in an almost infinite variety of subjects. As a matter of fact, very few young men who take up work in the College of Engineering have definite plans for the specialized work which they expect to do after graduation. For that reason, most of us believe that the engineering colleges must give the fundamentals of science and mathematics, with a limited amount of specialization, and that in all cases the fundamentals must be given precedence, for they can not easily be secured except in college."

A Professor of Mechanical Engineering at Sheffield Scientific School, Yale University, says:

"Acknowledging your general letter of March 3d addressed to the Sheffield Scientific School I wash to say that we appreciate both the importance of the subject and the emphasis you have placed upon it. Our undergraduate instruction includes training in principles and methods of attacking engineering problems. Our graduate instruction is more specialized in the various branches of engineering. I am interested to note that you "believe that some day in the future some of our large universities will be conferring a degree of Welding Engineer." I doubt if our large engineering institutions will ever give such specialized degrees as this but I do think the student should be taught to appreciate what can be done and if the field interests them sufficiently they may enter this field upon graduation. We should be glad to keep in touch with you from time to time."

The Victor Oxy-Acetylene Equipment Co., San Francisco, have opened offices at 10 North Jefferson Street, Chicago.

On and after May 1st the New York office of the Imperial Brass Mfg. Co. will be located in the Longacre Building, Suite 605, 42nd and Broadway.



AS FLEXIBLE AS A LINER'S ENGINES

PREST-O-LITE service functions like the giant liner's engines. In harbor these smoothly revolve at a snail's pace, yet at a signal instantly develop their maximum horse power. It matters not what the emergency is these steam wonders respond efficiently, and just when needed.

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is marketed through an organization which, like the liner's engines, is flexible because it is designed to efficiently serve not only the thousand cylinder consumption of one plant, but equally well the one cylinder requirement of another.

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PW-506

ADVERTISING THE JOB SHOP

Editor:

It has been about a month since we sent you our opening announcement and items of our advertising matter. Since that time I am pleased to state our business had developed beyond all expectations. This development can only be attributed to advertising. We have taken advantage of every opportunity to get the name of the firm before the public—paid ads, written articles, discussion columns, civic promotion movements, and anything else that will get us publicity without discredit.

It is really gratifying to go into some distant plant and have those in charge tell us we have already been heard of, either through the press or the spoken word. Here I might state that front page ads in the small paper are the real medium. Direct questioning has shown us more results from that source than from the inside of a paper having double the circulation.

We were pleased to honor a request from the local school board that the high school chemistry class be allowed to visit our shop at regular intervals for demonstrations and rudimentary instructions in welding. Electric and gas welding are subjects discussed by them during class hours, and our aid to them will be the means of sending first hand information of the field covered by welding directly into the homes of the people.

The degree of Welding Engineer will be fine in its place, but let's first work towards the degree of WELDER. In that manner only will we be able to protect the trade from annihilation by the army of boiler inspectors and insurance men who constantly croak, "Good welding isn't possible." In my travels hardly a day passes that I do not see some boiler job which is quite a simple problem for a GOOD welder, but cannot be done, with the consequent saving to the owner, because of his insurance policy. On the other hand, jobs just as simple have been welded, where permissible, and the failures are due only to ROTTEN WORKMANSHIP.

I had occasion today to examine a boiler which had been converted into a crude oil storage tank. The tubes and a section of each head had been removed with a cutting torch, and a one-half inch plate welded over the holes. There was about fifteen feet of welding on each end, and to all appearances it was very good, the ripples were evenly spaced, and the fillet was plenty heavy enough, but when pressure was put on the tank the plate let go at the weld and showed that not even good adhesion had been obtained. The shear marks were still visible on the edges of the patch. This tank was made by the Whitelaw Wrecking Company, 306 Main Street, San Francisco, Cal., for the Little River Redwood Company, of Bulwinkle, Cal., and they had stenciled their ADVERTISEMENT on the patches.

It is only by giving these things publicity that better supervision, which means BETTER WELDING, can ever be obtained.

You asked us for our opinion of your new advertising campaign for job shops. Our approval is best expressed by asking you to kindly put us in touch with this company at your earliest convenience, and suggest to them that they send some newspaper copy along with their letter to us. Without doubt their cuts and illustrations will put in the punch which our past ads have lacked.

P. W. Westfall,

Eureka Welding Works, Eureka, Cal.

TENSION WELDING

In reply to a recent question as to the exact number of states now prohibiting tension welding, Mr. H. S. Smith, president, International Acetylene Association, informs us as follows:

"I do not know of any states that have actually prohibited tension welding in general. I conclude that what you have in mind are certain restrictions which are enforced with regard to the application of the oxy-acetylene welding process in boiler construction and repair. Some 18 states have adopted in its entirety, or with certain mild reservations, the boiler code of the American Society of Mechanical Engineers as the boiler code for the state.

"Rule 16 of the A. S. M. E. Boiler Code reads as follows:

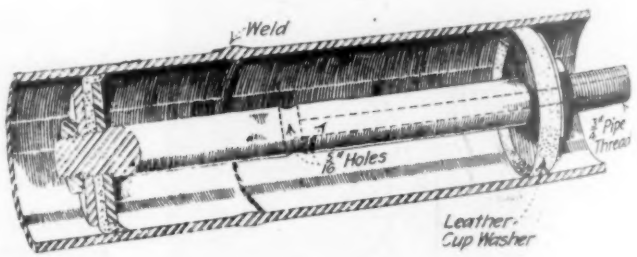
"Welded Joints. The ultimate strength of a joint which has been properly welded by the forging process, shall be taken as 28,500 lb. per sq. in., with steel plates having a range in tensile strength of 45,000 lb. per sq. in. Autogenous welding may be used in boilers in cases where the strain is carried by other construction which conforms to the requirements of the code and where the safety of the structure is not dependent upon the strength of the weld.

"Unfortunately, this particular rule prevents the safe ending or re-ending of boiler tubes and flues, as tubes and flues are generally in tension, although the strain to which they are submitted is very slight. It is the intention of the International Acetylene Association to approach the Boiler Code Committee in this matter and try to get them to permit the safe ending of tubes and flues under certain conditions.

"The Boiler Code Committee has recently issued a tentative draft of rules which will cover unfired pressure vessels. The tentative set of rules prohibits the employment of fusion welding on any pressure vessels larger than 6 inches in diameter and where the pressure exceeds 15 lbs. to the square inch. If this rule should be adopted it would be a most serious matter for the welding industry, and we are going to have a pretty fight on our hands."

WELD-TESTING DEVICE

In order to test welds in boiler tubes, the device illustrated was made. It consists of two pistons, made as shown, one to come on each side of the weld. A rubber hose is attached to the rod projection, and compressed air is admitted through the hollow rod and outlets. Thick soapsuds are applied to

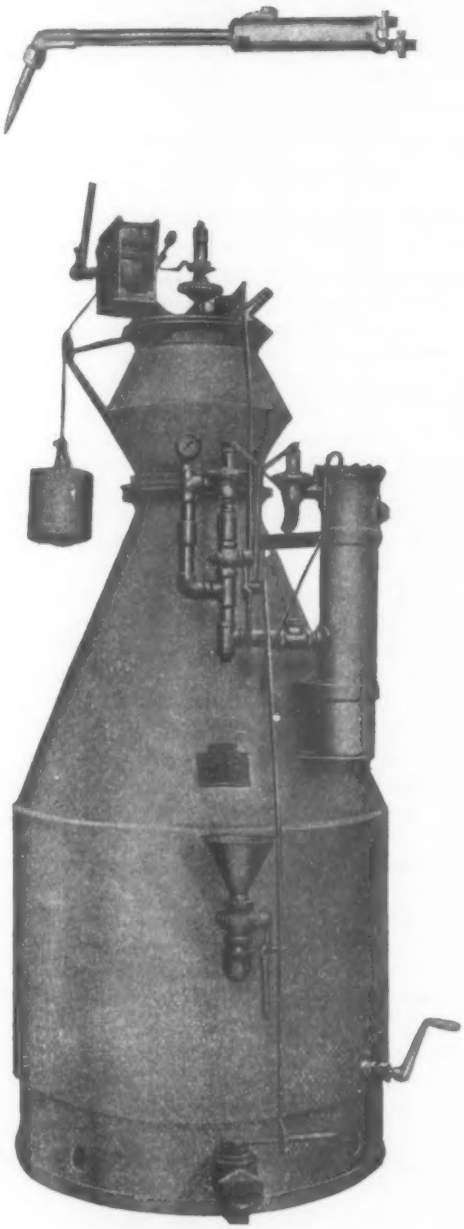


the tube over the weld, and if a leak is present bubbles will form. No defective welds have got past since the tester has been used, whereas before its use several tubes had to be removed after they had been put in the boiler and steam raised.

—R. McLaren in *Power*.

E. W. Reynolds, formerly of the Chicago sales forces of the Davis-Bournonville Co., has resigned to become special agent for the Connecticut General Life Insurance Co., Chicago.

MILBURN Oxy-Acetylene Apparatus



THAT much abused word "efficiency" is better understood when we remember that "simplicity is the soul of efficiency." With a realization of this truth we know immediately why Milburn welding and cutting torches are so exceedingly efficient. They are, first of all, simple in design, construction and operation.

This is true not only of the Milburn torch, but of all Milburn apparatus. The large industrial acetylene generator plants, as installed by us for the United States Government in navy yards, etc., are remarkably simple in plan and construction. The same simplicity is carried through all Milburn apparatus, with the result that each type of apparatus is most efficient in its particular field of work.

In buying any oxy-acetylene apparatus, specify Milburn products. It means for you better work, greater economy, and apparatus that will stand hard usage with minimum repairs.

Simplicity in design, simplicity in construction, simplicity in operation—these are the fundamental reasons for Milburn efficiency, and they are sound seasons why you should specify Milburn apparatus.

Write for catalogue No. 22.

Milburn welding and cutting torches are covered by U. S. patents and the Alexander Milburn Company guarantees full protection to vendors and users of its products.

The ALEXANDER MILBURN CO.

BALTIMORE, MARYLAND

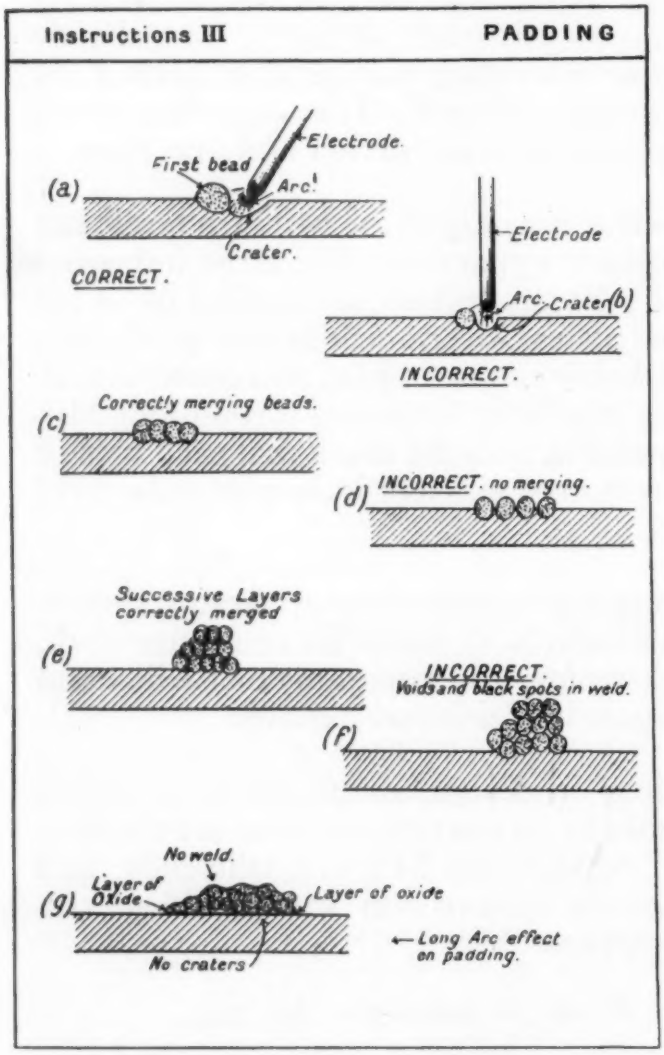
New York	Philadelphia	Chicago	Pittsburgh	San Francisco
51 East 42d Street	Bourse Bldg.	1012 Kimball Bldg.	202 Martin Bldg.	268 Market Street

Agencies throughout the United States and Canada

PADDING*

Padding, in general, is a succession of beads run parallel to each other and offers a great field for usefulness in building up worn parts or parts machined down too far for subsequent machining to the correct size. In laying these pads parallel, the electrode must be held so that the arc bites into the preceding pad and the parent metal at the same time as shown in Fig. A, Instruction 3. If the arc is held as in Fig. B, a good joint will be had to the parent metal, but little or no joint to the first bead, and in machining these, weld voids will be found as black or dross spots as can be imagined from Fig. F.

Fig. C shows these beads correctly merged, and Fig. D



shows the beads perfectly welded to the plate, but no merging, and hence no good for subsequent machining.

In commercial padding the choice of running the beads lengthwise or crosswise of the work is to be had and, in general, lengthwise is the more desirable as the piece has more time to absorb the excess heat of the arc before returning to supply more heat. In either case the outer edge should be gone around with the bead for each layer so that a sort of trough can be formed while the metal is cool and shows the least disposition to run away. For quick rough work this trough could then be filled in by spreading, as is shown in the preceding lesson, but in general, successive lines of beads is much the more reliable method. After the making of a reasonably smooth pad on a horizontal flat surface is attained, making a pad on a vertical surface is next in order, running a bead horizontally with successive beads directly over it, and later making the pad both from the bottom up in vertical layers horizontally, and from the top down. In making these pads overhead, it will be noted that the only hard bead to put up there is the first one, and when welding against this first bead and the parent metal, the operator will be able to notice correct conditions for drawing the arc equally from both, as in that case the metal shows the least disposition to fall.

This overhead welding has no function of negative or positive polarity, but simply the fact that one liquid drop will remain on the ceiling, excess over one drop falls, leaving one there is the secret of overhead welding.

It has probably been noted before this that in welding no drops should appear at the end of the electrode, that is, when the arc is held the right length and the metal flows evenly, the metal of the electrode passes to the fluid bowl as a gas or vapor and condenses on the parent metal as a liquid rapidly changing into a viscous and then a solid mass. The ripply appearance of the finished weld being successively frozen ripples of the liquid pool due to the magnetized effect of the current in the arc when just at the point of freezing. In general, overhead welding requires more current for the same conditions, as the arc must be held closer, which means slightly less voltage and hence, to make up the same heat, the current must be raised. As stated before, the one trick in overhead welding is in getting started and holding an absolutely unbroken close arc. A great aid in holding this close arc is for the operator to rest his body and left elbow, if he is right handed, against the piece to be welded, steadying his right hand, holding the electrode holder.

Another way is to put the right elbow up against the overhead surface and to use the elbow as a center and guide for bringing the hand and electrode up at an even rate. In overhead welding, the operator will best see how the electrode must be fed into the weld at the exact rate the electrode is being melted. Another method still in order to feed the electrode at an even rate, is to use the elbow of the welding hand resting on the knee, and raising from the toe at the rate desired. Another permissible method for welding, and especially useful in overhead or vertical welding, is to use a stick similar to an artist's brush guide rest. Overhead welding, even when unsuccessfully tried, shows what is required for first and successful pads more quickly than any amount of verbal or written instructions. Padding by beads should only be done with bare wire or flux-coated electrodes, as slag-coated electrodes are only successfully applied by spreading, as shown successful padding is the merging of the pads with the parent metal and with each other.

Proper current densities to use when welding medium average work, that is, ½-inch ship plates, are:

	Amp. Per Sq. In.
For bare wire electrodes	8,000 to 9,000
For flux-coated electrodes	7,000 to 8,000
For Slag-coated electrodes	6,000 to 7,000

For light and thin work this must be reduced, and for very heavy work it can be raised.

Welding at less current density on ½-inch plate will not result in maximum strength of weld or best results. On our alternating-current machines plugging in taps are marked for various types of electrodes; hence current density correct automatically.

*Instruction No. 3, from the handbook of the Electric Arc Cutting & Welding Co., 222 Halsey Street, Newark, N. J. Copies of the complete instruction book may be had from this company at $1.25 each.

A BLACK EYE

For Autogenous Welding

The American Railway Association, at its last convention adopted a rule that welding would not be permitted on certain vital locomotive and car parts, because results are variable, because welds tested proved to be of inferior quality, because of improper workmanship.

Not because they CANNOT get good welds, but because they do not.

Isn't this a serious enough situation for everyone interested in welding appliances to take up vigorously before other industries take the same attitude? We know most of the causes—lack of uniformity in practice, in mixture of gases, in treatment, etc., and some of them we can eliminate definitely.

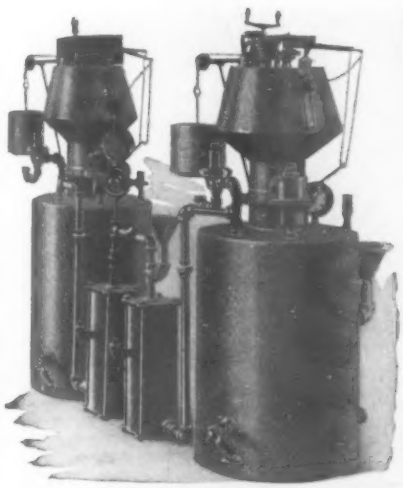
One prolific cause of unreliable welds is improper mixture of gases. The torch manufacturer gives the most precise instructions, but the welder has no way to carry them out. How can he tell when his mixture is 1.12, 1.14, or 1.20 parts of bottled oxygen to 1 part of acetylene?

The Hydrex Flow Indicator shows at each and every instant the exact volume of each gas being consumed by the torch, thus it shows the mixture, and is the only accurate, reliable guide to correct mixtures.

A card will bring complete information; or an instrument for ten days' free trial. An engineer will give you a free demonstration without obligation if you wish. Write now.

Hydrex Engineering Corporation

73 West Eagle Street **BUFFALO, N. Y.**



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Regulators
Safety lighters
Carbon rods
Carbon paste
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Electric and Oil Preheaters
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Tobin bronze rods
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Aluminum rods
Aluminum solder
Brazing wire
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Norway
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Asbestos gloves
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"V" Blocks

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Our New England States Representative,
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Hamilton, Ohio

Fyber-Weld GOGGLES for Welders

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Frame is made entirely of vulcanized fibre, and in addition to being light in weight is a non-conductor of heat and electricity, is non-inflammable and infusible, is not affected by moisture or perspiration and is easily sterilized and kept sanitary. Has flexible leather center, ventilated side pieces and adjustable elastic headband.

Prices as follows:

No. 510, fitted Essentialite lenses, No. 4 shade, for cutting and cover glasses.....$3.00 pair
No. 510, fitted Essentialite lenses, No. 6 shade, for welding and cover glasses.....$3.00 pair
No. 510, fitted with amber, smoked green or deep blue, cobco blue and cover glasses.$2.50 pair
Extra cover glasses in clear or amber tint..... .20 pair

"ESSENTIALITE" LENSES

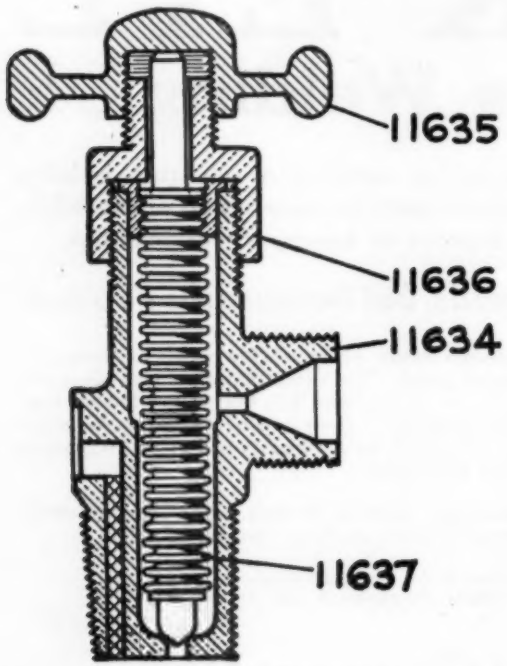
To those of our patrons who are not thoroughly conversant with the real qualities and benefits of "Essentialite" lenses, we take pleasure in furnishing the following information. In placing the "Essentialite" before the trade, we have, after years of experimenting and research, succeeded in discovering the means of protecting the delicate organism of sight against the destructive Ultra Violet rays. We have demonstrated conclusively that with these lenses we vanquish the so-called "fatigue-weariness" and headaches caused by Ultra Violet and Infra Red rays.

Manufactured By **CHICAGO EYE-SHIELD CO., 2300 Warren Ave., Chicago, Ill.**

NEW HIGH PRESSURE VALVE

A new high pressure cylinder valve is being marketed by the K. & M. Co., 30 Church St., New York City.

The Safety High Pressure Cylinder Valve is an entirely new principle in valve design developed for high pressure



service and proven in service on several thousand cylinders.

The valve stem is kept absolutely tight without the use of any packing. In fact, the simple one piece stem is the entire valve mechanism in itself.

No loss of cylinder contents due to valve leakage in service or transit; a big item in reducing maintenance costs.

No filled cylinders returned to shipper because valves cannot be opened; another saving in maintenance costs.

The body is made of very dense metal to secure strength and non-porosity.

It is provided with the required fusible plug for relieving pressure in case of fire.

It has a heavy square central body section for applying wrench when screwing valve into neck of cylinder.

NEW NAME IN OXY-ACETYLENE FIELD

The Oxweld Acetylene Co., of Newark, N. J., and Chicago, has recently extended its manufacture of oxy-acetylene apparatus and equipment to include "Eveready" welding and cutting outfits.

"Eveready" is a new name in the oxy-acetylene field, but the apparatus is not new, excepting for certain refinements of design, having been used extensively in the metal-working trades for several years under the name of "Prest-O-Lite" apparatus.

The new name was adopted by the Oxweld company to suggest the ready convenience, adaptability and general-purpose uses of the equipment. The apparatus is designed to use exclusively with compressed acetylene in cylinders, thus providing the welder and cutter a compact and complete portable outfit.

"Eveready" outfits and supplies are moderately priced and are sold through distributors direct to the retail trade.

CAST IRON PLANER BED WELDED TOGETHER IN THE MIDDLE

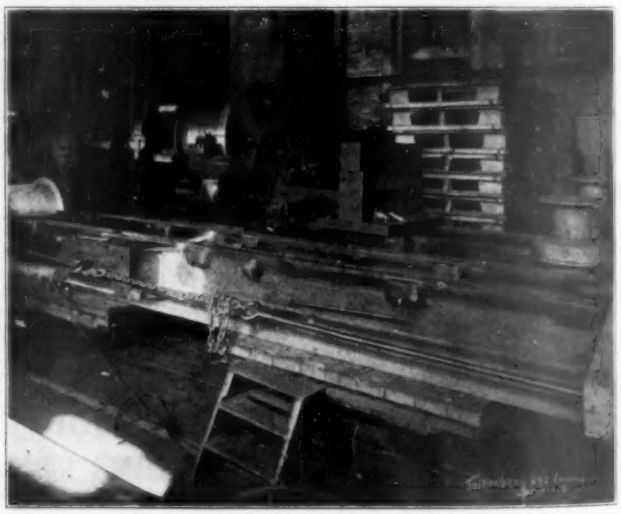
Cast iron offers many difficulties to the welder and some of the difficulties are incident to the design of the parts welded rather than to the cast iron itself.

The job shown in the accompanying illustrations is interesting, principally on account of the fact that the weld had to be made without appreciable distortion of the parts, and the joint had to be finished so that the weld could not be readily detected.

The job in question relates to a large planer bed 20 feet long and weighing approximately 12 tons. This bed is part of a 60x60-inch planer, and was broken into two parts approximately in the middle. The line of the break was 84 inches and the welding was done from both the inside and the outside, making an external welding line of 168 inches.

In doing this work it was first necessary to assemble the parts in exact alignment and position. This was done by setting up two long inverted "V's" and laying the planer bed upside down on these "V's," then the parts were drawn together with screws in a huge clamp as shown in the illustrations. Having cut out the joint with air tools the welding was done according to usual practice, using a steel pencil and special steel reinforcing plates. When finished the exterior surface was ground flush with that of the original casting, so that were it not for the chalk put on for the purpose of photographing, the weld would be entirely invisible to the eye.

There are two remarkable achievements in this job; first, the absence of distortion and second the strength of the joint. The absence of distortion is proven by the fact that the ways were in perfect alignment when the job was completed, and furthermore a spiral gear with its bearings which was located in the middle right adjacent to the weld and incidentally interfered considerably with the welder was found in perfect alignment after job was completed.



Welded Planer Bed.

As for strength, this was tested at two different times—first when the welding was about two-thirds done it was necessary to turn over the bed. This was done by putting a sling around the middle at the weld and hoisting which put the maximum strain of the weight of the bed on the weld. During the operation of turning over, the bed was dropped some three or four inches on the floor and was bumped around considerably, all of which put excessive strains on the partially completed weld and yet there was no sign of weakness. The work was done for the Lidgerwood Manufacturing Co., by the Electric Welding Company of America.

Superior Brazing Compound

A product of years of time and study. Over 98 per cent pure boron. Its use is not attended by deposit or scale. Acts as a superior flux and purifies the brazing spelter, causing spelter to flow evenly into every part of joint, without deposit, scale or enamel. A trial will convince the experienced welder of the merits of Superior Brazing Compound.

If your dealer cannot supply you, we will.

Standard Mfg. Co.
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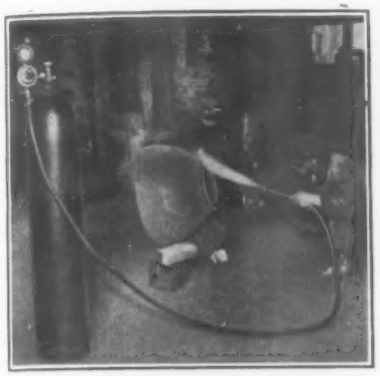
Cheaper than any other compressed gas



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Brazing
Cutting
Welding
Cast Iron

Rockgas Product Company

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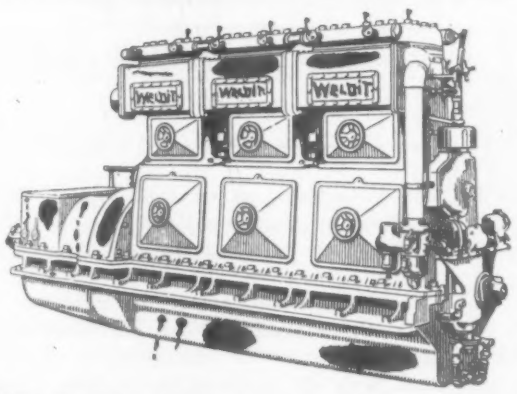


Weldit Metal Mender

Stops All Leaks

Finishes all welds as smooth as glass, the same shade and appearance as cast iron; splendid for any metal.

A great many welds are rough and pitted. Simply heat weld or leak up to a good warm heat and our WELDIT Metal Mender will melt on the warm metal and as soon as cool the mender will harden to a very hard, exceedingly tight, sticking film that is water and acid tight. Your work then leaves your place finely finished, smooth and clean, with no leaks.

No experience needed—simply heat and melt on.

Supplied in sticks about ½-inch diameter by 6-inch long; used by scores of foundries for patching bad spots in castings, and by welders for stopping leaks and finishing up poor looking welds. Any kind of heat that will warm the metal is all that is necessary.

As important to a welder or foundryman as his telephone.

Black marks on above sketch will give an idea of how it is used.

Price $2.00 per pound—runs from 10 to 11 sticks to the pound.

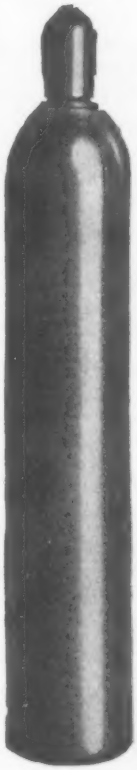
One of the most valuable inventions since the introduction of welding.

SPECIALISTS IN HIGHEST GRADE WELDING EQUIPMENT AT HONEST PRICES.

WELDIT ACETYLENE CO.
68 Grand River Avenue, West, Detroit, Mich.

Manufacturers of

SEAMLESS STEEL CYLINDERS



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ELECTRIC BUTT WELDS

The butt weld is probably the most extensively used and the most efficient of welds, some writers claiming as high as 90 to 100 per cent efficiency in mild steels; this claim undoubtedly being based on the fact that the great majority of butt welds when put in tension break outside the joint.

The wide use of this method in manufacturing various parts, especially in the automobile industry, for joining yoke ends to connecting rods, putting eyes on brace rods, welding splines and spiders to universal joint shafts, etc., justifies a thorough study of the method.

The writer has had occasion to test a number of such welds and has prepared a group of test bars of various steels the results from which should be interesting to those engaged in the welding industry. The pieces under consideration were cut from 1-inch bar stock having the following specifications:

(A) Bessmer cold-rolled, 1-inch bar stock.
Carbon, .15—.20 per cent.
Manganese, .65—.80 per cent.
Phosphorus, .085—.1 per cent.
Sulfur, .09—.095 per cent.
Silicon, .020—.1 per cent.
(B) Basic open-hearth hot-rolled, 1-inch bar stock.
Carbon, .25—.30 per cent.
Manganese, .50—.60 per cent.
Phosphorus, .015—.035 per cent.
Sulfur, .035—.045 per cent.
Silicon, .021—.1 per cent.
(C) Basic open-hearth, hot-rolled, 1-inch bar stock.
Carbon, .30—.35 per cent.
Manganese, .60—.70 per cent.
Phosphorus, .01—.03 per cent.
Sulfur, .04—.05 per cent.
Silicon, .1—.2 per cent.
Nickel, 1.20—1.50 per cent.
Chromium, .35—.50 per cent.

The cut pieces were welded first and afterward turned to standard test bars which were broken in an Olsen testing machine so the pieces represent the inside of the weld, the bars being turned to less than half the original size. Two bars of each lot were heat treated, one being annealed and the other quenched in water. Although the heat treated bars do not show any comparative results they give a good idea of the change in physical properties that take place under heat treatment. The bars are marked as follows:

A_1—B_1—C_1 Original bar.
A_2—B_2—C_2 As welded.
A_3—B_3—C_3 Annealed.
A_4—B_4—C_4 Quenched.
B_5 Quenched drawn.

	A_1	A_2	A_3	A_4
Elastic limit (lbs. per sq. in)	74,250	49,750	37,500	56 000
Tensile strength (lbs. per sq. in.)	83,000	62,250	57,500	75,750
Elongation (per cent in 2 ins.)	17.19	.....	35.80	19.53
Per cent reduction of area	53.50	.....	66.00	44.50

	B_1	B_2	B_3	B_4
Elastic limit (lbs. per sq. in.)	79,500	40,250	59,375	84,750
Tensile strength (lbs. per sq. in.)	94,500	72,500	87,750	129,500
Elongation (per cent in 2 ins.)	13.28	31.25	12.50	.....
Per cent reduction of area	39.00	49.00	37.00	.....

	C_1	C_2	C_3	C_4
Elastic limit (lbs. per sq. in.)	62,500	48,250	25,000	60,500
Tensile strength (lbs. per sq. in)	73,250	70,000	55,750	80,875
Elongation (per cent in 2 ins.)	17.19	20.30	35.00	22.66
Per cent reduction of area	57.00	61.50	66.00	66.00

Before turning to test bars a welded piece of each group was polished and tested with the schleroscope to determine the range of softening caused by the welding heat. In each case there was a zone of from one-eighth to three-sixteenths of an inch on each side of the weld that showed distinctly softer than the original material. (3 to 5 points.) Table I shows the comparative results.

	A	B	C
Per cent reduction of elastic limit between welded and original bar	32.9	25.9	22.8
Per cent reduction in tensile strength between welded and original bar	25.	7.1	4.4
Per cent increase of elongation between welded and original bar	.....	5.8	17.5
Per cent increase in reduction of area between welded and original bar	.....	5.1	7.8

Table I.

It will be noted from the table below that in each case except A_3, A_4 and B_4 the test bar broke outside the weld. A_2 and B_4 were distinctly poor welds and broke off squarely

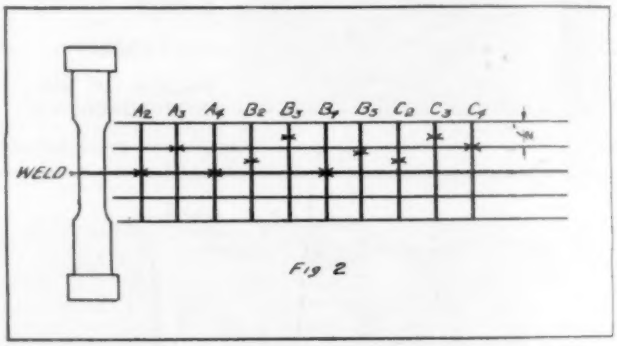


Fig 2

showing little or no elongation or reduction of area, A_4 showed a good joint and gave good reduction of area and elongation. Figure two shows where the fracture occurred in each case.

A_2 B_2 and C_2 show an ultimate strength efficiency of 75, 92.9 and 95.6 per cent respectively, but fall considerably in elastic limit, A_1 having only 67.1; B4, 74.7 and C_2, 77.2 per cent as compared with the original bars. The elongation and reduction of area in the chrome-nickel steel show a considerable increase while A_2 showed no results owing to a poor joint.

It is surprising to note that both the alloy and higher carbon steel show appreciably better results than the low carbon steel. The reason for this being no doubt due to the poor joint. Further investigation would undoubtedly show the low carbon steel to have better comparative results.

The breaks occurring outside the weld in nearly every case no information was to be had from an examination of the fractures. In every case, however, there was an easily noticeable reduction of area at the weld even though fracture occurred outside.

M. Edward Boyd.

The Davis-Bournonville Co., have moved their Minneapolis offices to 300 Builders Exchange Building. J. N. Harkins is District Sales Manager.

IMPERIAL
WELDING CUTTING EQUIPMENT

You can't afford to use less than the best facilities in your repair work. Imperial Welding and Cutting Equipment is first in Safety, Speed, Economy and Efficiency. Its maintenance cost is low because of the small gas consumption, and a single operation often pays for its cost.

We are headquarters for Welding, Cutting, Carbon Burning and Lead Burning Equipment and Supplies of all kinds and ship on short notice. Write for the Imperial Catalog and full, detailed information regarding methods of operation, economies effected, etc.

IMPERIAL BRASS MFG. CO.

522 S. Racine Avenue CHICAGO, ILL.

Large rope drive pulley broken in seven pieces. Welded with Imperial Equipment.

RED SEAL FLUXES

The Best is the Cheapest

We offer the same FLUX that we have been using in our own shop, which is the largest in the SOUTH, for eight years. RED SEAL FLUXES are the best that can be bought at any price and at much lower prices than many inferior brands.

RED SEAL CAST IRON FLUX	Per lb.
1 to 5 lbs.	$0.50
5 to 10 lbs.	.45
10 to 25 lbs.	.42
25 to 50 lbs.	.40
50 to 100 lbs.	.37
100 lbs. or over	.35

Prices on FLUXES for other metals furnished upon application.

Cast Iron Rods, Welding Wire for Steel, Aluminum Rods, Tobin Bronze.

Write for Jobber's prices.

Memphis Welding Co.

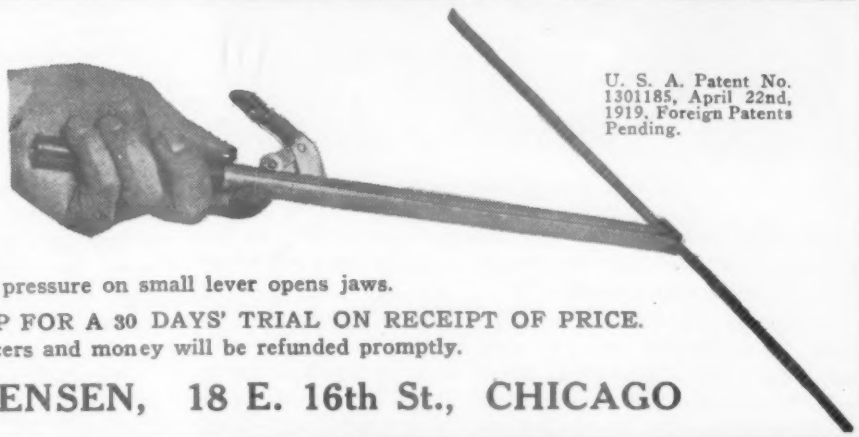
MEMPHIS, TENN.

WELDING PINCER

MODEL 3

Price, $1.00—3 for $2.50

Length, 16 inches. Weight, ½ pound. Holds the welding rod rigid at angle shown.



U. S. A. Patent No. 1301185, April 22nd, 1919. Foreign Patents Pending.

A slight pressure on small lever opens jaws.

SENT TO ANY WELDING SHOP FOR A 30 DAYS' TRIAL ON RECEIPT OF PRICE.
If not needed after that, return pincers and money will be refunded promptly.

Jobbers and Agents, write **C. SORENSEN, 18 E. 16th St., CHICAGO**

Campbell's "Oxy-Acetylene" Welding Manual

By Lieutenant Lorn Campbell, Jr.
Ordnance Corps, U. S. A.

Lieut. Campbell organized and conducted the Army Welding School at Peoria, Ill. His new manual is based on his experience there, in training soldier welders. 154 pages, 89 illustrations, bound in cloth, $1.25.

THE WELDING ENGINEER
Chicago, Ill.
608 S. Dearborn St.,

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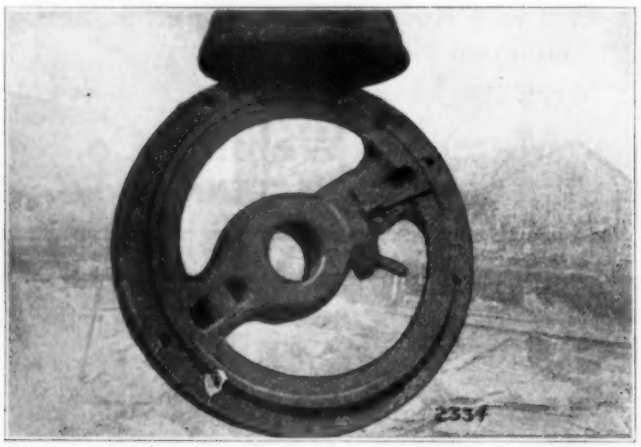
A DIFFICULT ROCK CRUSHER REPAIR

The accompanying illustration shows a difficult Thermit weld recently made in 3½ days on a cast-iron rock crusher.

This machine was owned by a private company and had been previously welded with oxy-acetylene, but this proved very unsatisfactory. The owners were losing $250 a day on account of the broken machine and it would have required from 30 to 60 days to replace it together with the cost of a new casting. The piece was therefore sent to the railroad shops at Spencer, N. C., and Thermit welded by R. A. McCall and F. A. Jarrett.

In making the weld a gap was cut out at the location of the break. This gap was filled up with yellow wax as a pattern. A mold box was then built around the wax pattern. The flame of a preheating torch was then directed through gates in the mold, serving to burn out the wax in order to leave space for the Thermit steel to enter later, and also for the purpose of preheating the sections to be welded to a suitable welding temperature.

In the case of this repair, as with other repairs of ring-shaped sections, care had to be taken to heat up the parts of the casting opposite the weld, so that when the weld cooled, contraction would be even and no strains set up. On account of the position of the break it was difficult to secure sufficient expansion by heating without getting it out of



Thermit Welded Rock Crusher.

round. The rock crusher frame was heated two-thirds of the way around and heating was continued for an hour and a half after the weld was poured.

In pouring the weld 495 pounds of cast-iron Thermit were used. The Thermit mixture consisted of iron oxide and aluminum, with additions of 3 per cent ferro-silicon 50/50 and 20 per cent mild steel punchings. This material was placed in a crucible suspended over the mold box. Upon ignition by means of special ignition powder the iron oxide and aluminum reacted to produce superheated steel and slag (aluminum oxide) at a temperature of 5,000 degrees Fahrenheit. The molten steel thus formed was precipitated to the bottom of the crucible, and at the end of the reaction period was tapped from the bottom of the crucible into the mold.

AGRICULTURAL WELDING.

Editor: For a long time I have delayed writing you concerning a request you made long ago to hear from some of us welders who handle some agricultural work. During the seasons, we weld quite a variety of this kind of work, but have never considered it much apart from other job welding. Most of it is light work with binder and corn planter parts, largely malleable, which Tobin bronze readily take cares of. Also, lots of it is steel welding. Only mowers have much gray iron castings. We weld quite a few cultivator wheels with spokes broken off, even with malleable and sometimes gray iron hubs, sometimes pressed steel hubs. This is a very undesirable looking job, but for some reason they rarely ever come back and are easily welded with what metal the hub may be. We also weld lots of automobile parts. We also repair some white metal, or Franklin metal parts, using some kind of metal scraps such as odd magneto castings. Prepare same as for welding. Use gasoline torch and old hack saw blade or like puddle stick and wipe it on. Care must be taken that work does not get too much heat and collapse. Small aluminum castings are readily soldered with same metal and method.

Harry Kerslake.

WELDED TANK HOLDS TIGHT IN TAMPA HOLOCAUST

Out of the debris of a $400,000 fire that swept two blocks of Tampa's industrial district last December, practically the only salvage was a 12-gallon welded oil storage tank, which was afterwards found intact excepting for dents and scars that were later removed. Inspection showed that the welded seams held tight at every point, no leak developing anywhere in the welds.

The tank contained 5,000 gallons of gasoline at the time of the fire. When the platform supporting it was consumed the tank fell to the ground, smashing a 5-inch outlet pipe. Roofing, beams and frame work fell in and burned on top of the tank. Also a brick wall of an adjacent building collapsed, hurling tons of the brick on the conical top of the tank and bending the cone head below the level of the top tank ring. The tank was located approximately in the center of the burned area.

This example of the strength and endurance of welding is noteworthy because the unusual shocks and strains to which the tank was subjected and because the tank itself is typical of welded structures of the kind. The specifications of the tank are: Diameter, 16 feet; depth, 8½ feet (11 feet including the cone head); bottom ring, No. 10 gauge iron; top ring, No. 12 gauge iron; conical top, No. 14 gauge iron.

The tank was built by the American Welding & Tank Co., of Tampa, Fla., who have been engaged for a number of years in plate welding, building water tanks, smoke stacks, pressure tanks, storage tanks, etc. It was constructed on the premises where only a 2-foot clearance was allowed, making the work unusually difficult. The tank is in service today, as good as the day it was finished. Oxweld apparatus was used.

ANNOUNCING THE SANI PRODUCTS CO.

A new organization, the Sani Products Co., has been formed for merchandising the entire catalogued products of the Marietta Manufacturing Co., of Indianapolis, Ind., and the Chicago Hardware Foundry Co., of North Chicago, Ill.

Sales and display rooms and general offices will be located in the Sani Building, 209 West Randolph Street, Chicago, Ill. The organization will be completed June 1st.

Mr. C. G. Marks who has been associated with the Chicago Hardware Foundry Co., for the past twelve years and general sales and advertising manager for the past four years, will be general manager and director of sales for the new organization. The Sani Products Co. is to be congratulated in securing an expert for this important position—a man who has had vast experience in products catering to the food and soft-drink industry.

By the combination of our selling organization under one head, service to the trade will be greatly improved.

SCORED CYLINDERS

and cracked water jackets successfully repaired. Our factory nearest you will make these repairs on a 24-hour service basis.

Regrinding of cylinders that have been scored by wrist pins or through other causes is unnecessary. The Lawrence Patent Process fuses a silver-nickel alloy into the defects making a quick, clean, permanent job **without altering the bore of the cylinder.** Same piston and rings fit.

Cracked Water Jackets are Also Made Permanently Good through this Same Process

A list of our factories and licensees is given below. There is one near you. Send your scored cylinders and cracked water jackets to the nearest plant. There we will insure you quick service and perfect results. Aside from the liberal arrangements we make with you, the money saving service you render your customers will help make you known as a concern that looks after their interests—and this is a business asset in itself.

We guarantee all of our work. Write to any of our plants for full information.

PLANTS

Buffalo—10 Summer St.
Chicago—1522 Michigan Ave.
Cleveland—6529 Euclid Ave.
Detroit—1246 E. Jefferson Ave.
Los Angeles—1030 S. Grand Ave.
Milwaukee—18 Martin St.
Minneapolis—14 N. 9th Street.
Newark—292 Halsey Street.
New York City—791 Eleventh Ave.
Philadelphia—1601 Summer St.
Pittsburgh—5102 Baum Blvd.
San Francisco—116 Hyde St.

LICENSEES

Akron, Ohio—Akron Welding Co.
Amsterdam, N. Y.—Matthew Harrison, 58 Union Street.
Bridgeport, Conn.—United Welding & Repair Co., 172 Elm St.
Cincinnati, Ohio—Cincinnati Welding Co., 410 Richmond St.
Columbus, Ohio—Central Ohio Welding Co., 200 East Lynn St.
Denver, Col.—Blanchette Welding Co., 149 South Broadway.
Erie, Pa.—Lake Erie Welding & Spring Co., 338 W. 12th St.
Grand Rapids, Mich.—Ox-Welding Company.
Harrisburg, Pa.—Harrisburg Welding & Brazing Co., 94 South Cameron St.
Hudson, N. Y.—Hudson Welding & Repair Works, 22 Spring St.
Kansas City, Mo.—General Auto Parts Co., 1621 Grand Ave.
Lima, Ohio.—Buckeye Welding & Repair Shop, 133 Water St.
Memphis, Tenn.—J. B. Cook Auto & Machine Co., 294 Washington Ave.
New Haven, Conn.—New Haven Welding Co., 763 State St.
Portland, Me.—Portland Garage Co., 49 Cross St.
Providence, R. I.—Rhode Island Score Filling Co., 173 Eddy St.
Richmond, Va.—F. D. Schluter Auto & Welding Co., 1009 W. Broad St.
St. Louis, Mo.—Scored Cylinder Repair Works, 325 N. Jefferson Ave.
Schenectady, N. Y.—Franken Oxy-Acetylene Welding Co., 5 Villa Road.
Springfield, Mass.—Hoag Welding Co., 31 E. Court St.
Troy, N. Y.—Reliable Auto Repair Shop, 229 River St.
Washington, D. C.—Day Welding Co., 43 Sumner Court, N. W.
Worcester, Mass.—Central Autogenous Welding Mfg. Co., 98 Union St.
Yonkers, N. Y.—Kipfer Engineering Co., 11 Nepperhan St.
Youngstown, Ohio—C. F. Erb, 722 Madison Ave.
Montreal, Canada—Pyke Motor & Yacht Co., 374 Notre Dame St.
Regina, Sask., Canada—Capital Welding Shop, 1762 Osler St.
Toronto, Canada—Ontario Motor Car Co., Ltd., 18 Bloor St., East.
Windsor, Canada—L. Lawrence & Co., 41 Sandwich St. W.
Melbourne, Australia—Finlay Bros., 322 Elizabeth St.

ESTABLISHED 1862

L. LAWRENCE & CO.

WOOLWORTH BLDG
NEW YORK CITY

A FEW TERRITORIES STILL OPEN FOR LICENSEES

Classified Ads

Help Wanted—50c per line, minimum 4 lines.
Jobs Wanted—4 lines free.
Other Ads—75c per line, minimum 4 lines.
Counted 8 words to line. Add 6 words for keyed address.

Wanted—Salesmen, Demonstrators, Welders and others meeting the welding trade to solicit subscriptions to *The Welding Engineer,* or furnish names of possible readers. When you put your friend or customer in touch with this publication you do him a real favor—make it possible for him to learn more about autogenous welding, liberal proposition. Write me now. Yours for welding, Mackenzie.

ATTENTION, WELDERS & GARAGEMEN

We can furnish you with a SCORED CYLINDER MATERIAL with complete instructions for applying the same at $4.00 per bar, experience not necessary, our flux does the trick. We are the Inventor of the Johnson Patented Engine Suport Bracket for Ford Automobiles, and used before as a prevention, or after braek occurs in crank case. Price $1.50 each. Wilkes-Barre Welding Co., Wilkes-Barre, Pa. Established 1910.

For Sale: Welding shop in good sized Minnesota city. Thoroughly equipped. Did an $8,700 business in 1918 and $7,900 in 1919. Because of health wish to sell; $4,500 takes it; part cash. A splendid opportunity for a good, all around welder. Address 14, care *The Welding Engineer.*

For Sale: Two 100-pound Davis Bournonville acetylene generators, $150 each; 1 20-pound Davis Bournonville acetylene generator, $20. Weldrite Co., 104 Hunter Avenue, Long Island City, N. Y. 4t-4-5-6

Wanted: Representatives for well-known welding apparatus line in the following cities: St. Louis, Birmingham, New Orleans, Houston, Atlanta, Memphis. Splendid proposition for experienced men familiar with the welding trade in these territories. Address 12, care *The Welding Engineer.*

Wanted—Four electric welders to weld on ¼-inch steel plate work. Usual rate of pay with bonus running as high as 50 per cent. Work fifty-nine hours per week and living conditions are good. State experience on welding water-tight work and how soon available. Fabricated Steel Products Corp., Leetonia, Ohio. Mar-Apr.

VACANCIES

The Alexander Milburn Co., of Baltimore, have opportunities for several executives and salesmen thoroughly experienced in both manufacturing and sales departments of the Oxy-Acetylene industry.

Address in confidence, stating age, experience and earning capacity.

Wanted: Welder of custom shop experience, capable of handling heavy castings and steel and aluminum. Highest wages paid. Address 10, care *The Welding Engineer.* 1t-Apr.

Wanted: Man capable of handling minor Rego type regulator and U. S. gauge repairs; testing welding and cutting torches. To a man capable of handling this work and qualifying as assistant production superintendent a factory in Kansas City offers unlimited possibilities for advancement. Give full details of experience and references. Address 11, care *The Welding Engineer.*

Partner Wanted—Oxy-acetylene welder would like to hear from someone with a small shop needing an active partner or foreman. At present employed as Master Welder. Address 15 care The Welding Engineer. 1t-Apr.

Wanted—One or two W. K. Prest. Tanks. State best price. Address F. W. Otte, Herington, Kans. 1t-Apr.

The Economy Welding Machine Co., Kansas City, Mo., is distributing a new catalog devoted to Economy "Peerless" apparatus and supplies.

The National Association of Sheet Metal Contractors will meet in annual convention at Peoria, Ill., June 8, 9, 10 and 11.

For Sale: One 25-pound Vulcan acetylene generator, practically new, $60. Address 13, care *The Welding Engineer.*

Job Wanted: First-class all around welder. Seven years' experience. Will go anywhere. Capable of demonstrating work. Best references. H. S. Emery, 603 Lord Street, Indianapolis, Ind. 1t-Apr.

Wanted: Salesmen, demonstrators and welders to sell preheating and brazing outfits to welding shops, repair shops, garages, etc. Very profitable side line. Write at once to Aeroil Burner Co., Inc., Union Hill, N. J. 1t-Apr.

New D-B Generator

For Sale: One brand new Davis-Bournonville acetylene generator. Purchased in October, 1918, and due to cancellation of war contracts it was never uncrated. Latest type, approved by National Board of Fire Underwriters. Capacity 300 pounds, of 1¼x⅜-inch carbide. A bargain. Write or wire. Littleford Bros., Cincinnati, Ohio. 1t-Apr.

Wanted—2nd hand carbide kegs. Size approx. 12½" diam. x 23" high. Must be in good condition with either friction or screw lids. Advise quantity. Address, C. K., care *The Welding Engineer.* 4-t-2-3-4-5

First class welder capable of taking charge of established custom shop on Pacific Coast. Give experience and money wanted. Address B 89, care *The Welding Engineer.* Mar-Apr.

For Sale: A 50-pound (slightly used) Henderson-Willis Kanwell acetylene generator at $175. Also a new 25-pound, same kind, at $150, f. o. b. St. Louis, Mo. Address Sligo Iron Store Co., St. Louis, Mo. 1t-Apr.

Wanted: First-class welder, capable of taking charge of established custom shop on Pacific Coast. Give experience and money wanted. Address B89, care *The Welding Engineer*

DIRECTORY OF WELDING SCHOOLS

Davis-Bournonville Institute, Jersey City, N. J.
Y. M. C. A. Automobile School, Denver, Colo. Instructor in charge, E. J. Thomson.
Lane Technical High School, Chicago. Instructor in charge, G. J. Coleman.
Michigan State Automobile School, Detroit.
Sweeney Auto School, Kansas City, Mo.
Engineers School for Oxy-Acetylene Welders, Washington Barracks, D. C.
Cass Technical High School, Detroit, Mich. Instructor in charge, E. A. Berkley.
Ralston School, Pittsburgh, Pa.
Salt Lake Technical High School, Salt Lake City, Utah. Instructor in charge, Ernest F. Voleker.
Electric Arc Welding & Cutting Co., Newark, N. J.

AND NOW THE DETACHABLE BROOM HANDLE

This is the day of H. C. L. plus—but it is also the day of new and crafty ways of sidestepping the onslaughts of the ulgy ogre. The latest device to enlist on the side of the people is the detachable broom handle.

At first thought the broom handle seems inconsequential. Isolated and individualy it is. Multiply it by some 50,000,000 or more, which probably approximates the number of brooms sold yearly in the United States, and you have something quite different.

The detachable broom handle is a brand new idea and it is "taking." At the present time there is a factory in Vermont devoted exclusively to manufacturing brooms with this

An Interesting Welding Job.

type of handle. The handle is of wood, fitted into a welded metal holder that clamps easily onto the brush of the broom. The metal part is light, but very strong, being securely welded by the oxy-acetylene process, which not only makes it rigid, but allows the entire piece to be neatly finished.

This is but one of a long list of interesting new departures from man's habitual thriftlessness that have sprung out of the need for widespread economies to combat living costs. In fact, the oxy-acetylene process itself is perhaps the most far reaching of all modern economies in the metal-working industries. Owing to the superior quality of welds made by this process, its remarkable speed and almost unbelievable economy, it is now almost universally applied in manufacture, construction and repair work.

J. Philip Furbeck, recently a Captain in the Engineer Corps, U. S. A., has resigned his position as District Manager of the Oxweld Railroad Service Company to resume the practice of Mining Engineering. Mr. Furbeck will start for Alaska at once.

WELDERS

Make sure of your supply of Oxygen. No matter how large or how small, **Levin** Cells will answer your requirements.

Levin Cells are a unit—small and compact. Construction is simple—a few standardized parts. The **Levin Cell** represents simplicity, safety and continuity and economy of operation.

Where demands for gases are not large small installations of **Levin Cells** may be installed, and as the demand increases additional cells may be installed with little trouble.

Our Engineering Department is at your service. Consult us for technical advice.

THE ELECTROLABS COMPANY

2635 Penn Avenue Pittsburgh, Pa.

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ELECTROLYTIC GAS SPECIALISTS

Branch Offices
30 Church Street New York City **Morris Building Philadelphia, Pa.** **Merchants Exchange Bldg. San Francisco, Calif.**

Under the Technical Supervision of Electrolytic Oxy-Hydrogen Laboratories, Inc.

CUTTING WIRE ROPE

Proper provision for the protection of human life in mines demands frequent and regular inspection of hoisting cables by responsible persons and the employment of approved processes in effecting needed repairs. A section devoted to "hoisting ropes" in the draft of a law to cover mine rules and regulations, proposed by the United States Bureau of Mines, is evidence of the extent to which the cutting of wire rope is now required in the maintenance of mine equipment.

The approved method of cutting the rope preparatory to resocketing and reclamping is the well-known oxy-acetylene process. There is no simpler or easier way. A typical outfit that has been found dependable comprises a standard oxweld cutting blowpipe, a Linde oxygen cylinder and a tank of Prest-O-Lite dissolved acetylene. With this equipment a competent operator cuts through a 2-inch cable in just about two minutes. The cutting apparatus is portable, so that it may be easily set up anywhere on a moment's notice.

The savings in time and expense in the cutting of rope may very profitably be extended to discarded rope, which may be reduced to lengths for use in other ways, such as for railing, fences, etc.

By adding the welding blowpipe to the equipment noted above the mine is provided a complete outfit for the speedy repair of broken machinery, making it unnecessary to depend on machine shop repairs or costly replacements.

THERMIT CHANGES

The Metal & Thermit Corporation, New York, N. Y., in order to more adequately take care of its rapidly increasing business in the New England states and in Canada, ha sappointed Mr. James G. McCarty manager of its Canadian branch, with headquarters in Toronto, and has transferred Mr. Robert L. Browne from its New York office to Boston where he will have charge of all sales in the New England states.

Mr. McCarty was graduated from Stevens Institute of Technology in 1906 and became affiliated with the Metal & Thermit Corporation in 1909. He has had a wide and varied experience with all phases of the Thermit process and has represented the company in many sections of the United States and Canada.

Mr. Browne has been associated with the New York office of this company since 1917. His assignment to the New England states will enable customers in that territory to receive much closer attention and co-operation than has been possible in the past, a service for which Mr. Browne is eminently fitted, both by technical education, and practical experience.

BIG OIL TANK RUNS WILD

In a little Alabama town where the Welded Process Co., of Birmingham, was recently engaged in setting up one of its big oil storage tanks, the population witnessed the strange spectacle of a runaway tank in action. The tank, a great cylinder of the welded type now superseding the riveted tanks in many places, was being lowered to its concrete foundation when the stay lines snapped, resulting in a sheer drop of a dozen feet. The empty cylinder bounced like a rubber ball from the hard base, which was several feet above the ground, hurled to earth and started on a cross-country sprint that was not halted until it had flattened out a tool house in its path and plunged with resounding clangor a distance of 200 yards across an adjacent field, where, its momentum spent, it rested.

The remarkable feature of the accident was that the tank, which was seemingly headed to certain destruction, was found, on examination, to have sustained no injury beyond a few dents in its metal plates. These were easily hammered out after welded seams were intact and unimpaired at every point, no leak developing anywhere in the structure.

The staunchness of the big tank, which has a capacity of 15,000 gallons and which is 24 feet in length by 10½ feet in diameter, is attributable to the welding process used (oxy-acetylene).

CUTTING LEAD

Editor:

Sometime back about five months, I was engaged in cutting out a four foot section of a 36-inch suction pipe at the local water-works pumping station. Our job was to put a 36-inch gate in the 36-inch line. Having cut the required piece to let the valve in, which we did by a large cutting off machine, we examined the next joint which had been giving trouble by leaking. We found the lead joint very bad and concluded to relead it. Our problem was to melt the lead out. We tried two large preheating torches but owing to the close quarters and nearness to the floor, the torches set fire to the building. Then we tried a welding torch but the melted lead run on the cold lead and froze. Then we tried a cutting torch and did the job in about an hour's time. We would heat the lead until it melted then turn on the cutting jet and the melted metal would go partly in yellow smoke. Once we got a hole thru the inside of the joint, it was easy sailing as the cutting jet would blow the melted lead thru. I never heard of the cutting torch being used for this purpose before. We used the largest cutting tip and two cylinders of oxygen and nearly one cylinder of acetylene. I think the main thing is to get a hole thru the lead to the inside first.

George M. Hamilton

The skilled welder avoids, as much as possible, going back over his work and finishing it. The best welding is progressive welding without ever retracing and correcting defects. Aim to weld so that there are no defects and therefore no necessity of correcting them. It requires heat, gas and time to remelt adding material, and every time it is remelted there is a distinct loss in strength and metal. It is highly important to choose a tip of the correct size which will insure sound work at a rate of progression within the operator's control. If the tip is too small the rate of progression will be so slow that no operator can maintain it. He must necessarily work over and over the same metal. The advantage of the large tip is that the heat lost by radiation is less, proportionately, than with the small tip. The rule then is to choose the largest tip that can be applied successfully by the welder without overheating the metal or working so rapidly that he cannot do the job justice.

Autogenous Welding.

NEW ELECTROLABS CATALOG

The Electrolabs Company, Pittsburgh, in a handsome illustrated catalog which has just been issued describes Levin Oxy-Hydrogen Cells. Included with the catalog is a data sheet, for the convenience of persons wishing information about possible installations. From the information thus given the Electrolabs Technical staff is able to tell prospective purchasers exactly what is needed. A copy of the catalog will be sent upon request.

Welding Rods

CAST IRON
MALLEABLE IRON
NORWAY IRON
NICKEL STEEL
VANADIUM STEEL
CAST ALUMINUM
MANGANESE BRONZE
TOBIN BRONZE

FLUXES FOR WELDING
ALL MATERIALS

QUALITY GUARANTEED

Bierman-Everett Foundry Co.
133-153 So. 20th St. Irvington, N. J.

The WIEDERWAX PREHEATER

is an appliance that pays for itself in a short time

It should be in every job welding shop and in the welding department of every foundry and machine shop.

It is unexcelled for preheating gray iron, steel, aluminum, bronze or brass castings.

It is built to take care of the smallest to the largest.

Send for our free booklet and get full data.

GEIST MANUFACTURING COMPANY
Department X
2001 ATLANTIC AVE.
ATLANTIC CITY, N. J.

This automatic acetylene generator is made right and works right. No clock-work to get out of order.

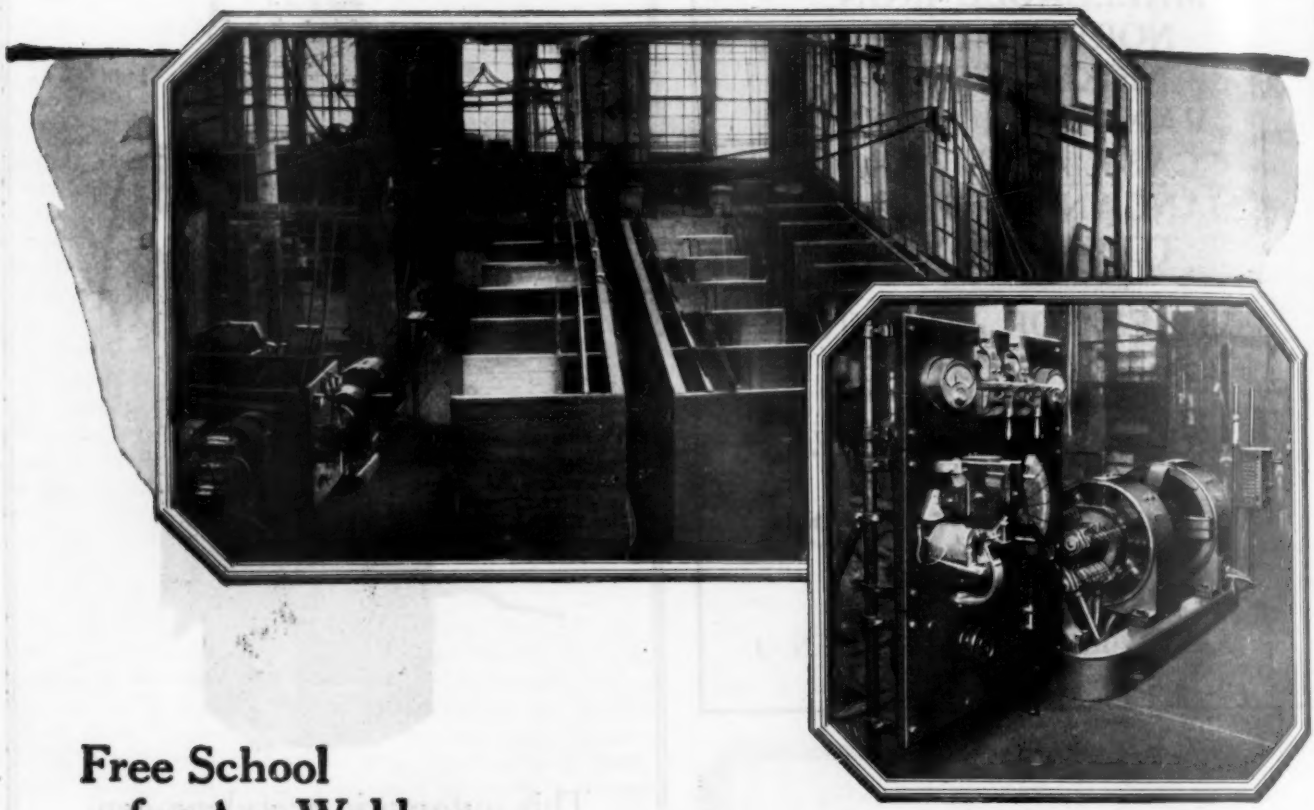
NO PREHEATING NECESSARY

to fill scores and mend water jackets with our Rep Flux and Rep Rods.

Try our Rep Flux when soldering radiators.

Sure Pressure Acetylene Generator Co.
1010-12 West Main Street
OKLAHOMA CITY, OKLAHOMA

Specialized industrial training eliminates mistakes that are costly in time and material.



Free School for Arc Welders

THE above illustration shows two views taken in the General Electric Company arc welding school at Schenectady, where courses are given in the following work:

Course 1: Repairs to steel castings.

Course 2: Repairs to iron castings.

Course 3: Repairs to steel plates and tanks.

Course 4: Recovery of broken taps and drills from castings.

Course 5: Welding of high-speed steel to low-carbon steel.

Course 6· Welding and cutting by carbon arc.

In from six to eight weeks men who have had no arc welding experience become efficient welders at the General Electric Company school in Schenectady.

Each student's record is kept and will be mailed on request to employer sending him to school.

This training is necessary as, unless operator holds a steady arc of uniform length, "cold welds" will be formed which will readily break open when subjected to a strain.

Dozens of prominent firms and departments of the U. S. Government availed themselves of the opportunity to have their men receive this exceptional training.

Instruction is free of charge to employees of those purchasing G-E arc welding equipment.

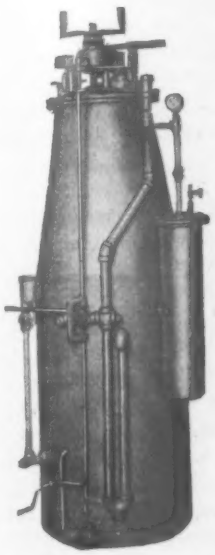
Send for Bulletin No .on 48953 Our Arc Welding School

43-254

General Electric Company

General Office Schenectady, N.Y.

Acetylene 1¼c per foot



If you generate it with a

MECO

Type CG Stationary Automatic Acetylene Generator

Made in 25-lb., 50-lb., 100-lb., 200-lb. and 300-lb. Capacity

Write for prices and literature

Modern Engineering Co.
23rd and Walnut Sts., ST. LOUIS, U. S. A.

We Can Save You Money On GAS and OXYGEN

USE

WELD Trade A Mark CAST FLUXES

"Weld-a-cast" is a scientific combination of chemicals, that causes the metal to melt rapidly shortening the operation, thus economizing in time, gas and oxygen.

"Weld-a-cast" adheres readily to the hot welding rod which picks up just enough and none is wasted; it does not blow away but melts at once; it eliminates blow holes and leaves the metal soft.

Write for Free Samples

CORTLAND WELDING COMPOUND CO.
CORTLAND, N. Y.

Genuine Swedish Charcoal Iron Bars

FEDERAL TOOL & ALLOY STEEL CORPORATION

Genuine Swedish Charcoal Iron Welding Wire

Best Swedish Brands
Immediate Shipments From American Stocks

There is no substitute for Genuine Swedish Charcoal Iron on the score of quality

Federal Tool & Alloy Steel Corporation

Thomas Towne, 1st Vice President and Gen. Mgr.

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66 Rutledge St., Brooklyn
1280 Ontario St., Cleveland
654 W. Lake St., Chicago
319 Metropolitan Bank Bldg., New Orleans

REMINISCENCES *of a* WELDER

The Rear Housing on That Darracq Car

TEN years ago the process of oxy-acetylene welding was introduced into this country. It was two years after that date—in 1908—that I climbed on the band wagon. So as time is reckoned it isn't very long, hardly long enough to justify the title of these little incidents, for the word "reminiscent" somehow impresses one as looking backward scores of years; yet none of these reminiscences are over eight years old.

But when the remarkable progress of oxy-acetylene welding and cutting in these few years is considered—the thousands of equipments in use, the big number of gas plants, the ease with which jobs are done now which were considered impossible a few years ago—in other words when we who were in the industry then and now compare these things, the years seem to lengthen.

I often wonder if it is because of this that welders are prone to add a few years to their actual experience. I've talked with men who nonchalantly stated that they learned oxy-acetylene welding in the Navy Yards in 1905—some years before any Navy Yard installed an equipment. Others casually announce that they worked for such or such a company some years before that particular such or such a company existed. Most of us have heard of the bachelor who, being told that statistics proved that married men lived longer than single ones, replied that they didn't live longer; it just seemed longer. Perhaps the welding industry affects us the same way, for surely it does seem longer than eight years ago that some of us knew so little about the wonderful qualities of this hottest of all flames.

I believe it was in 1909 that I had a monopoly on the oxy-acetylene welding business in a city of over 600,000 people. Another shop had started but had not survived. Their average on cylinders was about one in ten. Ours was a little better on that particular class of work but was nothing to boast about; but we were getting some fine practice—on the customer's job. It wasn't by any means an even bet that the owner of an aluminum case would get his case back in usable shape, once he entered our shop door; the odds were all against him. But automobile parts were terrifically high in price and the owner simply had to take his chances with the then poor and uncertain quality of welding work.

The oxy-acetylene industry has never extended to the automobile owner the proper credit for his share in the development of the industry. Think of the hundreds and perhaps thousands of welders who have been trained to repair work at the expense of a ruined auto casting or part. But the owner submitted because there was nothing else he could do. On the one hand, he was at the mercy of the manufacturer; on the other, the welding shop with its willingness to try and if successful, charge a salvage price—and in those days there were quite a few "successful" jobs from the welder's standpoint which did not measure up to the same standard from the owner's.

Came a morning when into the shop was toted one of the biggest rear housings, for a pleasure car, I have ever seen. It was from a Darracq taxicab and like all auto work was wanted in a hurry. It must be ready to put back to take advantage of the evening's trade. The car could be laid up in the daytime with little or no loss and later events proved this a fortunate thing for the owner. Could we weld it that day and how much would it cost? Sure we'd weld it that day. The cost was not so quickly decided upon, however, for those were the days when the successful job had to make up for the many unsuccessful ones. Finally, a price of $30.00 was agreed upon to weld a break about 14 to 16 inches long and about ⅜ inch thick.

This was our first rear housing job and we took it for granted that it was a steel casting. We were well aware that a rear housing must stand considerable strain and therefore cast iron should not be used. Which was sufficient evidence to us, in our blissful ignorant state, that if it wasn't cast iron it must be steel.

As the housing was completely broken the edges were ground down on a stationary grinder and after lining it up on a fire brick top table, we put the preheating flames on it to save gas by getting the line of welding to a red heat.

A mild steel rod was to be used for the filler rod and as the welding torch flame played on the break, the first surprise came. The metal melted queerly. It didn't have the clear, clean appearance of steel but seemed to be mottled and to melt sluggishly. As the rod was added, it didn't mix properly with the material. Holes appeared which could not be filled up. After a couple of inches of this kind of welding, a conference was decided upon. What the dickens was this metal anyway? Somebody suggested it was malleable iron and having read sometime, somewhere, that malleable iron was cast iron which had been annealed, the mild steel rod was discarded and a cast iron one substituted and again the weld was begun. This was something like it, the metal flowed better and to make a good job, we piled up that filler rod until the welded section was fully an inch thick. Then we played the preheating torch on it until it was a bright red, allowing it to cool slowly (this being our idea of proper annealing) and late that afternoon, the owner took the housing and we took his $30.00.

The next day was uneventful but the following morning back came the housing, broken directly through the weld. Followed the unusual autopsy. Cause of the break? Lack of alignment. So, laboriously that added iron was ground down. Did you ever try to grind malleable which has been melted? Lay in a stock of wheels before attempting it for it must be nearly as hard as a diamond.

This time we were careful in setting the job up and to make an extra good weld, perhaps it was made 1½ inches thick, but we used cast iron for the filler rod just the same as before and just the same as before the housing came back a couple of mornings later broken in the same place. Again the metal was ground down and again the job set up ready for welding. But this time we had to devise something new. Eureka! we had it. Cast iron was all right to fill the holes but it required steel for strength, so alternating with mild steel and cast iron we made the weld. Again we "annealed" it and for the third time the owner took it away.

Just how long he stayed away, I cannot at this time remember, but well do I remember how mad he was when he brought that housing back for the fourth time. And this was to be the last time. If it broke again, he wanted his money. We hardly blamed him, yet we needed him for two reasons—the fine experience we were getting and the $30.00.

At the suggestion of the shop superintendent, who had done considerable brazing, but who never could learn to operate the oxy-acetylene torch, we decided to give brazing a chance. Under his supervision three wrought iron straps

**In the latter part of 1916 and the early part of 1917 a series of six articles, "Reminiscences of a Welder," appeared in THE WELDING ENGINEER. They were unsigned, but we now feel free to state that they were written by Mr. M. Keith Dunham. The reader family of THE WELDING ENGINEER has changed a great deal since these articles were first published, therefore we are reprinting two of them, believing our readers will enjoy them.—EDITOR.*

were laid crosswise of the break and tacked on each end with the welding flame. Then a fire brick furnace was built and the preheating torches used to get the metal to a bright red heat. With flux and spelter running through the break which had been welded and around the straps, the job was finally completed and this time it didn't come back. We had learned something, but learned it at the cost of considerable money and lots of work. From using preheating flames to the oxy-acetylene flame was but a step and at the same time a brass rod was used instead of spelter. Later, brass was discarded and bronze employed.

We had learned what every welder should know and most of them do. How it is in the form of a

Moral: Malleable iron cannot be welded but it can be brazed.

The Man Who Wouldn't Learn

IN the reminiscence previous to this one, I spoke about the general knowledge of things metallurgical, which is obtained by the job welder. This applies as a rule. There are exceptions, of course, as there are, so they say, to all rules and this is a story of one of the exceptions. The thoughts of the earlier days bring to mind many of the lighter happenings in the shop which helped to cheer us along through our little tragedies of failures. And they brought to mind some memories of one particular old time welder. He's out of the game now; in fact, he never was really in it, just sort of hung around on the outskirts, so to speak. He never took advantage of the other fellow's mistakes nor in fact of his own. And knowing him so well, I hardly believe he'd read a trade paper, so the chances are he won't read this. A good many old timers in the East will recognize him and if by chance he does read this, I just want to square myself in advance by saying that while some of us have had many good laughs at his mistakes, we all liked him. We didn't laugh at him; only at what he did. He was one of the few job welders I have met who simply wouldn't, or couldn't, learn. We'll call him Bill.

Interrupting the story of Bill for a moment, I wonder why all the "bugs" eventually tell their discoveries to the job welder. In my time I reckon I've listened, more or less patiently, to all industrial revolutionizers. Steel automobile tires, apparatus for perfect kerosene combustion, aeroplanes which couldn't fall, autos propelled by carbonic gas or compressed air, gas, hot water heaters to put the coal barons out of business—I've had my share in helping build these and hundreds of other devices which were to set the world afire. But one particular invention I wish I knew the end of. The inventor of this was a typical "bug." Short in stature, long hair, a huge drooping mustache and bushy eyebrows, he was an ideal moving picture hero for a Nihilist bomb plot. To complete the painting, he carried an old black bag. Cautiously he inquired for the proprietor. Upon being told he was talking with him, he discreetly opened the bag and took out a device made of two flat aluminum bars, on each of which was an iron piece which slid back and forth. Could we shorten these bars one-quarter of an inch exactly. We thought we could. Well, there were sixteen of them and he was anxious to get them as soon as possible. Telling him to leave them and call the next day and they would be ready, he replied that it was impossible, that he must stay with them while they were being welded, as spies were constantly following him to find out his secret. Realizing that I had a real "nut" to contend with, and having lots of work to do, I called for the foreman and told the inventor that the foreman would personally weld them. Standing on his tiptoes to reach my ear (I was at least a foot taller than he) he whispered stagily that these pieces were the equalizers of his perpetual motion machine and that it was completed, everything ready except the shortening of the equalizers. This was one of the occasions when I was glad I was the boss; for the foreman had to listen for a matter of two or three

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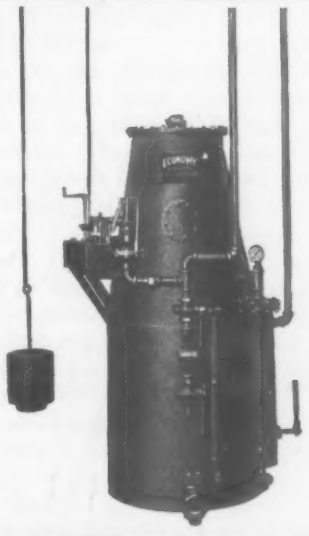

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hours to a long dissertation on that perpetual motion machine.

Reverting now to Bill whose ideas of the welding industry were (and still are, I think) on a par with the perpetual motion inventor. Bill's idea of welding was that the flame did all the thinking—all that was necessary was to own a welding outfit. Before welding was introduced into this country, Bill had had considerable experience in an industry closely allied with welding and he naturally gravitated into the job welding game. He worked for me two weeks and while I plead guilty to the fact that at that time my knowledge of welding was extremely limited, Bill's was a minus and after trying to tell him that it wasn't a good proposition to weld cast iron with steel and having Bill tell me that steel was considerably stronger and the weld would be sure to hold up if so made, we parted company and Bill opened up a job welding shop of his own.

His home was quite near our shop and he dropped in frequently on his way to and from his place. Taking advantage of his invitation to visit his shop, I went down to look his equipment over. Now, equipping a shop then was quite a bit costlier than it is now and Bill's equipment had cost him close to $3,000 and yet he had but one welding torch and that one wholly unsuitable for repair work, it being built for welding sheet metal and the limit of its work was about half-inch cast iron.

Other than being poorly equipped with the most important part of the job welding shop, his tools and appliances were very good. The day I happened to visit him there was lying on the floor a huge casting, a junk dealer's metal shears, which had broken in attempting to shear a piece of metal too large for them. The break was about sixteen inches through and abutted a shoulder about two feet thick. Now, jobs bigger than this have since been done with the oxy-acetylene flame, but at that time we classed them as impossible. That metal dealer had had those broken shears for some time and well do I remember our foreman talking on the telephone with him. Upon being informed that we could not weld them, he wanted to know from the foreman if we thought they could be cemented! But friend Bill was not afraid to tackle them with his little torch. Now, you readers have probably realized by this that Bill was the type of man who couldn't be reasoned with, so I just casually remarked upon the thickness of the casting and wondered how he was going to make the bevel. "Why," says Bill, "I'm going to take a cutting torch and cut the bevel from each side." Not daring to take issue with him over the practicability of cutting cast iron and yet not wanting him to waste his time on a job he couldn't do, I told him that getting that amount of metal hot enough to start welding would be a terrific job. Thereupon, Bill showed me eight pre-heating gas torches he had made from half-inch gas pipe. Lighting them all and turning on the blower he produced a long sickly looking flame without a sign of a blue cone and the total volume of heat emitted by the eight torches would have been just about right for a single cylinder from an automobile motor. I left him, knowing full well that he would tackle the job and some time later I saw the casting. After ascertaining that he couldn't cut the bevel with the cutting torch, he had actually started to fuse the break together on the surface. Finding that he could not do so, he had melted twenty or thirty pounds of welding rods on to the top, but in attempting to turn the casting over to do the same with the other side, the two pieces pulled apart and Bill gave the job up.

Some time after this, Bill came to the shop one night rather out of breath and stated that he wanted a real up-to-date cutting torch. All we had was the regular welding torch with a copper tube attachment to the side, but this was not suitable for Bill who advised us that he had taken a contract on a big cutting job and wanted a real cutter. There was at that time only one cutter of the so-called concentric type, which was what Bill was after; so he telegraphed for it to Buffalo and brought it in, proudly showed it to us, and told us that he had us skinned and was going out and get all the cutting work in that section.

A few days passed and one evening, just as we were getting through work for the day and were talking over the things to do on the morrow, a very tired, smutty faced, disconsolate Bill showed up. Slumping down on a stool and by his very air commanding our silence and attention, he said: "Boys, I just want to advise you that you can't cut bronze. I've tried for three days and used twenty tanks of oxygen on some propellor blades and it can't be done, so don't waste your money trying." There was an attempt to keep straight faces for perhaps half a minute and then we all yelled, but Bill couldn't see the joke then, and I doubt whether he ever did. Shortly after this event, Bill gave up his job welding shop. I met him about six months ago and he wanted to know if I thought the oxy-acetylene business ever would amount to anything.

Here's the moral: READING ABOUT THE OTHER FELLOW'S EXPERIENCES MAY PREVENT THE OTHER FELLOW HAVING THE LAUGH.

OXY-HYDROGEN CUTTING

As I had never had the opportunity to get an accurate cost on oxy-hydrogen cutting, either through experience of others or through my own work I was very glad to take the data on a recent job where I could get absolute facts and figures.

The work consisted in splitting a number of steel plates 13/16-in. thick by 26 ft. 10 in. long and was done by one of our spring motor cutting torch carriers with our standard straight line cutting with a No. 1 cutting tip made especially for hydrogen cutting.

As cutting is a process of burning we convert the iron to iron oxide or Fe_3O_4, which means that the burned iron is composed of three parts of iron and four parts of oxygen. Since the atomic weight of one part of iron is 56 as compared to 16 for oxygen, this means that the weight of the oxide would be composed of 3x56 unit weights of iron and 4x16 unit weights of oxygen, or a ratio by weight of 168 parts of iron to 64 parts of oxygen. In other words, if we were to take 232 lbs. of slag produced by cutting it would contain 64 lbs. or about 700 cu. ft. of oxygen and 168 lbs. of iron.

For means of comparison the following figures are set forth, showing what the gas consumption would be on this particular class of work if the cutting was done with theoretical efficiency.

$Fe_3O_4 = Fe\ 168\ O\ 64$ (pts. by weight).

26 ft. 10 in. = 322 in.

322 in. — 13/16-in. thick = 261.6 sq. in. of cut.

4 cuts = 1046.4 sq. in.

1046.4 sq. in. of cut 3/32 in. thick = 98.1 cu. in. metal removed.

Steel weighs .2831 lbs. per cu. in.

98.1 cu. in. weighs 27.8 lbs.

Now if all the oxygen used had combined with the iron to do the cutting we would require 64/168 of 27.8 lbs. or apprex. 10.6 lbs. of oxygen. As one lb. oxygen equals 11.209 cu. ft., the amount required theoretically is 118.81 cu. ft. In actual practice, however, we cannot obtain any such efficiency, as the cutting jet must be of sufficient volume and pressure to blow out the slag and clean the kerf of oxide. This means

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that an excess of oxygen must be used to do the more or less mechanical part of the work. In addition some oxygen must be supplied to combine with the hydrogen to provide the heating jet. None of this oxygen is used in converting the iron to $Fe_3 O_4$ and represents a total loss as far as the theoretical figures go.

Of course, if we expected to get down to exact figures we should have an analysis of the steel to be cut and allow for the oxygen necessary to convert the carbon and manganese to oxides, but the proportion is so small as to be almost negligible.

Now let us see what obtains in actual practice in the cutting of ordinary steel ship plates free from rust but coated with the usual amount of thin mill scale.

I set up the motor and after a short trial adjusted the oxygen pressure to 22 lbs. pressure and the hydrogen to 3 lbs. This oxygen pressure may appear a trifle high, but it must be remembered that it was not only efficiency in gas that was desired but also saving in time and there was too the friction of a 25 ft. length of hose to overcome. (I have often cut 1 inch steel with less than 10 lbs. pressure.) I then adjusted the speed of the machine to 14 inches per minute which was the maximum speed at which the cut would clear itself perfectly. The pressure gauges, previously tested for accuracy, showed 1,780 lbs. on the oxygen and 1,800 lbs. on the hydrogen drum. At the end of the run the gauges showed 305 lbs. on the oxygen and 1,175 lbs. on the hydrogen. As the drums were 200 cu. ft. capacity the consumption was $1475/9 = 164$ cu. ft. oxygen and $525/9 = 70$ cu. ft. of hydrogen. As the oxygen for the heating jet was supplied from the same drum and through the same regulator as the oxygen for the cutting jet it was impossible to determine the amount used in the heating jet, but I would estimate that it was approximately 30 cu. ft. as it was much more than is used in an oxy-hydrogen welding flame. This would leave 134 ft. oxygen for the actual cutting operation, which is but 15.19 cu. ft. more than the theoretical amount required. The kerf was just a few thousandths of an inch under 3/32 inch which would throw the balance against the efficiency slightly, but computing from the above figures it is shown that the actual results are 88 per cent of the theoretical figures. On account of the lack of definite figures on cost of cutting with either the oxy-acetylene or oxy-hydrogen process on actual cutting jobs it might not be amiss to compute the foregoing figures to show the approximate cost per sq. in. of cut.

Purity of oxygen 99.5.
Purity of hydrogen 99.8.
1,288 lineal inches 13/16 inch thick = 1046.4 sq. in.

164 cu. ft. oxygen @ 1½c	$2.46
70 cu. ft. hydrogen @ 1c	.70
Total gas cost	$3.17
Total oxygen cost per sq. in. cut	$.00235
Total hydrogen cost per sq. in. cut	.0007
Total gas cost per sq. in. cut	$.00305

Oxygen per lineal ft. 1.53 cu. ft.
Hydrogen per lineal ft. .65 cu. ft.
Total gas cost per lineal ft cut $.02945.

These figures cannot be obtained in free hand cutting and could not be expected, as the cutting jet must be maintained at a considerably higher presure to overcome the unsteadiness on the part of the operator. The heating flame must also be larger in free hand cutting, or the cut will frequently be lost requiring the operator to turn off the cutting jet and start over.

From the figures given me on the use of oxy-acetylene cutting in which the oxygen was approximately 98 per cent pure, the cost of the cut per lineal ft. was 6c. However, I did not conduct the test with oxy-acteylene and am taking the results obtained by the foreman in charge. He stated that the pressure in the oxygen was 35 lbs. and on the acetylene 8 lbs. The resulting cut was not nearly so smooth nor regular as that produced by the oxy-hydrogen and in addition there was an accumulation of slag at the bottom of the cut which was entirely absent when hydrogen was used.

We all know that if oxygen is diluted with a very small quantity of incombustible gas, such as carbon dioxide, its efficiency is greatly reduced and a decrease of 4 per cent in purity results in an increased consumption of 60 per cent in oxygen. But we may start out with a very pure oxygen in oxy-acetylene cutting still have a high consumption which would lead one to believe that the oxygen of the cutting jet is diluted after it leaves the cutting tip with the products of combustion of the heating flame, which contains carbon monoxide which is not present in the oxy-hydrogen flame.

It was interesting to note that when the heating jet was adjusted to heat at about the same rate as oxy-acetylene in starting the cut the top of the kerf was very slightly melted over making a rounded edge, but that when the flame was so adjusted that it required a half a minute or more to start the cut the top edges of the kerf were sharp and square as they were at the bottom. Although with the flame adjusted at a point requiring 30 seconds to start the cut, after it was once started no trouble was experienced by losing the cut and in every case the full 26 ft. 10 in. was cut without an interruption, except on the extreme end of one piece which had a thick scale of rust.

Although it is seen that in this particular case the consumption of hydrogen is considerably less than half the amount of oxygen, my experience has not been quite so satisfactory in cutting scrap iron, that is scrap boilers, etc. where there is more or less rust and boiler scale to contend with and also the frequent interruption of the cutting operation in shifting from one piece to the next. In cases of this kind the heating flame must be of ample capacity to penetrate the scale and to start the cut almost immediately. It is also the custom to have the torch burn while moving about from one cut to the next. This increases the hydrogen consumption about 100 per cent more or less depending on the operator. The thickness of the metal to be cut also determines the proportion of hydrogen used. It is probably safe to say that the amount of both gases used will be practically doubled.

If it would not complicate construction to the point of impracticability it would be a step in the right direction to make a cutting torch with a valve control that would open first the valve controlling the combustible gas, then the oxygen for heating jet and lastly the cutting jet valve.

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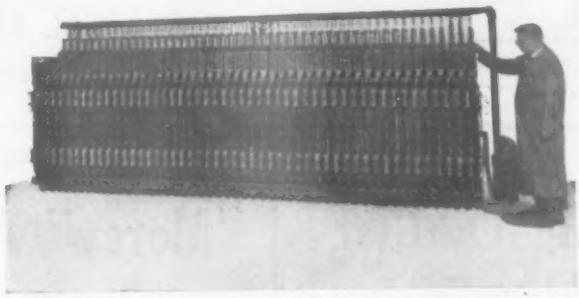

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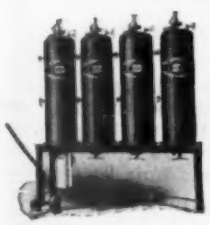

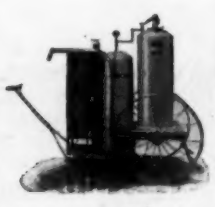

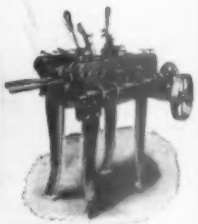

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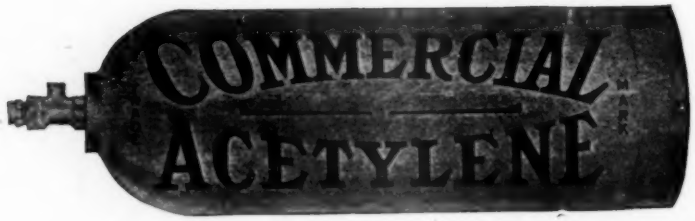

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